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Fire Safety Analysis of the 175' WLM(R) Coastal Buoy Tender

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16. Abstract

The WLM(R) Coastal Buoy Tender was a small cutter in the preliminary design stage at Marinette Marine Shipyard, Marinette, WI. This report documents the results of a comprehensive fire safety analysis of the design of the WLM(R) conducted under the Small Cutter Fire Protection (SCFP) project and provides a recommended class specific fire protection doctrine. The results of the analysis indicate that all of the compartments in the WLM(R) exceed their established fire safety objectives by a substantial margin with passive, automated, and manual fire protection features in effect. In fact, the analysis indicates that all compartments meet their fire safety objectives with only passive and automated fire protection features in effect. The fire protection doctrine provides: information pertinent to fire science in part A, suggested firefighting policy and guidance which would be provided by the Commandant, U.S. Coast Guard for small cutters in part B, and recommended procedures for combating all classes of fires in all compartments in part C.

The Ship Fire Safety Engineering Methodology (SFSEM), as implemented by the Ship Applied Fire Engineering (SAFE) computer program, was utilized as an analytical tool to conduct a comprehensive analysis of the baseline fire safety of the WLM(R) design compared to pre-established fire safety objectives. Various alternatives to the proposed design were studied to gain insight into the relative effect of certain design features on the baseline fire safety. The SFSEM/SAFE has been shown to be a valuable tool to evaluate heretofore incomparable entities such as a better barrier or a more effective firefighting system and quantify their effectiveness. This study demonstrates that it is feasible to use the SFSEM/SAFE to evaluate the fire safety design of a proposed design (as opposed to an actual ship). This would facilitate changes to the fire safety design early in the construction life cycle of a vessel and offer the largest cost savings potential. However, for the WLM(R), it is recommended that a similar fire safety analysis be completed of the actual vessel to verify the results based on the real shipboard conditions versus the assumptions required during the analysis of the design.

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METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (WEIGHT)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (EXACT)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 (exactly).

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (WEIGHT)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	0.125	cups	c
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (EXACT)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F

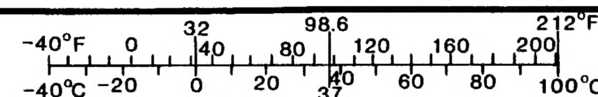

Table Of Contents

Table Of Contents
(continued)

List Of Figures

List Of Tables

LIST OF ABBREVIATIONS AND TERMS

ABS - American Bureau of Shipping

Active Fire Protection - Fire protection features designed to limit the flame movement by automatic detection, fixed fire extinguishing systems, and manual suppression systems or equipment. Examples of active fire protection features are: automatic sprinkler systems, fire extinguishers, and trained firefighting teams. See "Passive Fire Protection".

A value - The probability that an automated fixed fire protection system installed in a compartment will successfully extinguish the fire before FRI occurs.

AFFF - Aqueous Film Forming Foam. A firefighting agent particularly effective against class B fires.

Alternative Data Set - Data sets identified as "Alternative" have had the baseline input values to SAFE adjusted as necessary to reflect the impact of the proposed alterations or modifications which affect the ships' fire safety system.

AMTBL - Acceptable Mean Time Between Losses. See "FTA."

Baseline Data Set - Data sets identified as "Baseline" utilize input values to the SAFE program based on the physical condition of the ship found during the ship visit and are not influenced by any modifications or alterations which may be proposed as a result of an analysis.

CBO - Compartment Burnout - The point in the fire growth curve where exhaustion of all fuel due to pyrolysis occurs.

CBR - Chemical, Biological, Radiological

CFR - Code of Federal Regulations

CO_2 - Carbon Dioxide. A firefighting agent particularly effective against class C fires.

COR - Circular of Requirements

CSRLI - Cutter Standard Repair Locker Inventory

CUI - Compartment Use Indicator - The designation for a compartment selected from a list provided in SAFE used to define the type or function of the compartment and establish default values for various fire parameters.

Data Set - A data set describes those characteristics of a ship which affect its performance as a fire safety system. It includes information describing particular aspects of each compartment such as geometry, construction, fuel type and load, automatic detection and monitoring systems, ventilation and fire protection systems.

Dbar - The probability that a barrier will not fail due to durability or massive failure.

DCA - Damage Control Assistant

DCFF - Damage Control/Firefighting

EB - Established Burning - The point in the fire growth curve between ignition and FRI when the fire starts to grow exponentially with respect to time. In SAFE, it is assumed that this exponential growth varies with the 2nd power of time. EB is usually considered

equivalent to a flame 10" high. EB also signifies the demarcation between fire prevention and the beginning of the ship's response to the fire.

Fire Safety System - A term used to address the overall performance of a ship as it relates to fire safety. It considers the ship as a whole and accounts for such things as compartment geometry, construction, fuel type and load, automatic detection and monitoring systems, ventilation and fire protection systems.

FRAM - Fleet Rehabilitation and Maintenance

Frequency of Acceptable Loss (FAL) (years) - A component of "FSOS" which denotes the frequency with which a compartment can sustain a given Magnitude of Acceptable Loss (MAL). The FAL and MAL together establish the FSOS for a given compartment.

Frequency of EB - A frequency based on historic fire casualty data compiled from data provided by the U.S. Naval Safety Center and the Coast Guard's MISREP mishap reporting system.

FRI - Full Room Involvement - The point in the fire growth curve when the temperature in a compartment has increased 500°C above ambient. FRI conditions include surface burning of all combustibles and survival for unprotected personnel is not possible.

FRI Time - The elapsed time (in minutes) from EB to FRI calculated in SAFE using the Beyler/Peatross algorithm.

FSO - Fire Safety Objective - Performance standard ideally established by cognizant authorities for a compartment accounting for mission protection, property protection and life safety. The SFSEM is designed to analyze, quantify and compare the ship's performance as a fire safety system to achieve the established FSOS on a compartment by compartment basis. The FAL and MAL together establish the FSOS for a given compartment.

FTA - Fault Tree Analysis. An approach for establishing FSOS that takes into account the effect losing one compartment has on another; useful for situations where redundancies require multiple simultaneous losses before the ship's mission is affected.

FY - Fiscal Year (For example, FY94 is Oct. 1, 1993 to Sept. 30, 1994).

G-ENE - Naval Engineering Branch in the Engineering Division, USCG Headquarters

G-KSE - Safety Branch in the Health and Safety Division, USCG Headquarters

Halon - Halogenated Hydrocarbon. A firefighting agent particularly effective against all classes of fires, but presently banned from further production in accordance with the Montreal Protocol due to its ozone-depleting characteristics.

HVAC - Heating Ventilation and Air Conditioning system. The system on board a ship which supplies and/or exhausts warm and/or cool conditioned air to interior compartments.

Ignition - Point in the fire growth curve that denotes the beginning of pyrolysis of combustible fuel.

I value - The probability that the fire will self-extinguish at some point between EB and FRI.

MAL - Magnitude of Acceptable Loss - A component of FSOS which denotes the severity of damage that can be tolerated in a compartment. FAL and MAL together establish the FSOS for a given compartment.

MMA - Mid-life Maintenance Availability

M value - The probability that manual firefighting efforts will successfully extinguish the fire before FRI occurs.

NAVSEA - Naval Sea Systems Command

NERAC - Document retrieval and forwarding service for reports, periodicals, conference papers, annual reports, product literature, test reports, U.S. and foreign patent information and other printed material.

Non-Standard Scenario - Similar in all respects to a Standard Scenario except that it considers reduced levels of available fire protection systems.

NSTM - Naval Ship's Technical Manual

NWP - Naval Warfare Publication

One-Shot Halon System - A total flooding system with the capability to completely flood the protected space one time with the required concentration level of Halon 1301.

P-250 - A portable gasoline-powered pump.

Passive Fire Protection - Fire protection features designed to limit the flame movement by their presence alone. Barriers are the best example of passive fire protection, intumescent coatings, fire doors, fuel load distribution, and insulation of hot surfaces are other examples. See "Active Fire Protection".

PIR - Polar Icebreaker Replacement - Design for the replacement of the Coast Guard's Polar Icebreaker class. This design was the first application utilizing the SFSEM to perform a fire safety analysis and was conducted in 1987.

PMBTL - Predicted Mean Time Between Losses. See "FTA."

RLF - Relative Loss Factor - RLFS are calculated in SAFE as a means of assessing whether a target compartment or set meets FSOS. A Relative Loss Factor > 1 indicates that a compartment has failed. This factor is determined by multiplying the target's relative FAL given fire free state (calculated during a given run of SAFE) by the assigned FAL. A target is considered lost if its level of fire involvement for a given path exceeds the level specified by its MAL rating.

SAFE - Ship Applied Fire Engineering - The computerized implementation of the SFSEM.

SCBA - Self Contained Breathing Apparatus

Scenario - A situation defined by the user before executing a SAFE probabilistic model run. Such parameters as run time, ship location, material condition of readiness and firefighting configuration are specified.

SCFP - Small Cutter Fire Protection. Project sponsored by Commandant (G-ENE) to analyze fire safety on cutters less than 180' in length.

SFSEM - The Ship Fire Safety Engineering Methodology. A probabilistic-based risk analysis methodology used to analyze all aspects of the ship's performance in response to a fire compared to pre-established FSOS.

SHIPALT - Ship Alteration

SLEP - Service Life Extension Project

Standard Scenario - Scenarios used to fully define a ship's response to fire under the different operating conditions experienced by the vessel with full fire protection capabilities available.

Tbar - The probability that a barrier will not fail due to thermal or hot spot failure.

Two-Shot Halon System - A total flooding system with the capability to completely flood the protected space two times with the required concentration level of Halon 1301. This system is designed such that each shot of Halon is released from a different location in the vessel.

USCGC - United States Coast Guard Cutter

WLB - Ocean-going Buoy Tender

WLM(R) - Replacement Coastal Buoy Tender

WMEC - Medium Endurance Cutter

XRAY, YOKE and ZEBRA - Material Conditions of Readiness. Successively increasing readiness conditions for controlling damage. At each level, additional access closures, valves and fittings are required to be closed to limit fire and flooding.

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The authors are indebted to the numerous people who generously contributed their time and talent in conducting the fire safety analysis of the U. S. Coast Guard 175' WLM(R) Replacement Buoy Tender. Mrs. Bettie Proctor worked long hours in learning and using AutoCAD to produce the ship's drawings and ship visit forms. Mrs. Doris Rich provided excellent support with the database during the fire safety analysis phase of the project. The final report required embedding spreadsheets and graphics into the text; Mr. Lance Ryley ably assisted in this aspect of the final report. The Resident Inspectors Office at Marinette Marine Shipyard was extremely cooperative and provided information that improved the accuracy and validity of the analysis. The crew of the Coast Guard Cutter REDWOOD also provided their time and insight into typical fuel loads that can be expected on Coastal Buoy Tenders. Mr. Rob Richards not only contributed technically in the project, but he managed to maintain the sponsor's interest between project award and the final report. The professional and dedicated contributions provided by the entire project team is gratefully acknowledged and truly appreciated.

1. INTRODUCTION

1.1. BACKGROUND

The U.S. Coast Guard operates a large fleet of buoy tenders to maintain an extensive system of floating and fixed aids to navigation in the navigable waters of the United States including harbors, rivers, and coastal regions. The fleet includes 180' ocean-going buoy tenders, 157' and 133' coastal buoy tenders, and a variety of construction and river tenders that operate on the "Western" rivers such as the Mississippi, Missouri, and Ohio Rivers as well as selected Bays and Harbors such as the Chesapeake Bay. The fleet is geographically dispersed over the Atlantic and Pacific seaboards, Alaska, Hawaii, the Gulf of Mexico and all five Great Lakes. Due to the age of the existing cutters in the buoy tender fleet, the Coast Guard is in the process of replacing two classes of buoy tenders.

The Coast Guard has awarded two contracts to Marinette Marine Shipyard, Marinette, WI, to design and build a replacement class of buoy tenders for the aging 180' and 157' buoy tenders. "WLM(R)" is the designation for the replacement coastal buoy tender; Marinette has designed the WLM(R) to be a 175' long, standard displacement hull, all steel vessel. Marinette Marine is responsible for designing and building these ships in accordance with the guidance provided in the Circular of Requirements (COR) and other applicable regulatory authorities. The COR requires installation of certain firefighting equipment and ensures that fire safety is considered in the design. However, a formal fire safety analysis is not required by the COR.

The purpose of the Small Cutter Fire Protection (SCFP) project is to analyze the fire safety of Coast Guard Cutters greater than 65' and less than 180' long. The 175' Replacement Coastal Buoy Tender is therefore the largest cutter within the scope of the SCFP. The following sections provide additional background information on the Replacement Coastal Buoy Tender and the SCFP.

1.1.1. WLM(R) COASTAL BUOY TENDER REPLACEMENT

Coast Guard Headquarters specified general requirements for the WLM(R) in the COR.[1] The COR, in turn, requires Marinette to comply with the American Bureau of Shipping (ABS), Part C of Chapter II-2 to International Convention for Safety of Life at Sea (SOLAS), 46 Code of Federal regulations (CFR) Subchapter I, and other regulatory authorities for certain aspects of construction. This particular procurement requires Marinette to develop the preliminary or conceptual design of the ship. Marinette then develops the detailed design under the scrutiny of the USCG resident inspector and the ABS inspector. The construction drawings are then produced and the ship is built. When this project was started, the ship was in the preliminary or conceptual design phase. The keel had not been laid, the outfit had not been specified, and the detailed design was not finished. It is much easier and less expensive to implement changes in the fire protection features of a conceptual design than it is on the delivered ship. Thus, it is advantageous to conduct a fire safety analysis after the conceptual design is complete and before construction begins.

1.1.2. SMALL CUTTER FIRE PROTECTION PROJECT

The SCFP was initiated to examine all aspects of fire protection in small cutters. The original scope of the SCFP included nine classes of small Coast Guard Cutters including most of the Patrol Boats, Tugboats and Construction/River Buoy Tenders in the Coast Guard fleet. The primary objectives included analyzing the fire safety of the nine cutter classes and recommending improvements where needed. The deliverables in the project included interim and final technical reports including a fire protection doctrine tailored to suit each class of cutter studied. The technical approach specified the use of the Ship Fire Safety Engineering Methodology (SFSEM) as the analytical tool to evaluate the fire safety of the cutters studied.

The SFSEM is a probabilistic-based risk analysis methodology which provides an integrated framework to account for all relevant aspects of shipboard fire protection. The Theoretical Basis of the SFSEM is documented and available in the Marine Fire and Safety Research Branch Library at the U.S. Coast Guard Research and Development Center.[2] The SFSEM is designed to evaluate the ship's performance compared to pre-established FSOS. The methodology quantifies the contribution of passive and active fire protection systems, thus it provides a means for analyzing and comparing alternatives to improve the overall fire protection on the cutter. Since the SFSEM had only been used once before in the PIR Project, an objective was established in the SCFP to analyze the utility of this methodology and identify areas of improvement.

As documented in the final technical report for the SCFP, the utility of the SFSEM to analyze existing ships, identify problem compartments which fail to meet FSOS, and analyze the effectiveness of hypothetical alternatives to correct the problems was clearly demonstrated.[3] Theoretically, the SFSEM can be used in a similar manner to analyze a conceptual design of a vessel which has not been built. The 175' WLM(R) is within the scope of the SCFP project (all cutters between 65' and 180' in length) and it is in the conceptual design phase; therefore, a project to analyze the fire safety of the WLM(R) was undertaken.

1.2. SCOPE

The scope of this project is limited to analyzing the 175' WLM(R) Coastal Buoy Tender Replacement in the conceptual design phase at Marinette Marine Shipyard, Marinette, WI. It does not include the 225' WLB Ocean-going Buoy Tender Replacement presently under construction at Marinette because this ship is considered a large cutter and therefore outside the scope of the SCFP. The SFSEM requires a considerable amount of input data normally collected during a ship visit; in this project, a trip to Marinette Marine was conducted to collect additional information from the ship builder. In addition, a ship visit to the CGC REDWOOD (WLM 685), New London, CT, was performed to gain insight into typical fuel loads and standard operating procedures for an existing 157' WLM Coastal Buoy Tender. The SFSEM was again specified to be used as the analytical tool to evaluate the fire safety of the WLM(R).

FSOS establish the performance standards for the ship as a fire safety system. The SFSEM does not specify any particular approach for establishing FSOS. The FSOS were

established for the nine classes of cutters analyzed in the SCFP following the traditional (compartment by compartment) approach. The scope of this project included an effort to establish FSOS using the FTA approach if time and funds were available after completing an analysis using the traditional approach. These approaches are discussed in section 2.2.1 of this report.

1.3. OBJECTIVES

Three objectives were established for this project. The first and most important objective was to thoroughly evaluate the proposed fire safety design of the 175' WLM(R). "Fire safety design" in this context includes the proposed compartmentation, construction materials, fire protection systems, firefighting equipment, procedures and tactics and any other aspect of the proposed design that pertains to fire safety. Since the design of the ship is subject to constant improvement, this analysis was based on information concerning the preliminary design available to the USCG Research and Development Center in April, 1994. This information was supplemented by a visit to Marinette Marine Shipyard in April, 1994. The ship was to be studied in its normal operating configuration, in port and at sea, with a full complement of outfit and crew; it was assumed that the ship would be intact, and not subject to fires inflicted by enemy action or arson. Compartments which fail to meet pre-established FSOS were to be thoroughly studied to determine reasons for the problem, including an analysis of all the fire paths that contributed to the failure of the compartment to meet the FSOS. Hypothetical alternatives to improve the fire safety of any problem compartments were to be identified and a cost benefit analysis was to be conducted to form the basis for recommendations to Coast Guard Headquarters. The Coast Guard could then consider the costs that would be incurred in issuing an engineering change proposal as opposed to retrofitting the delivered ships using the SHIPALT process.

The second objective was to develop a tailored fire protection doctrine for the WLM(R). As a result of the work done in the SCFP, the fire protection doctrine for Coast Guard Cutters has been significantly expanded in scope and reformatted into three parts. Since Parts A and B of the fire protection doctrine in the new format were developed as part of the SCFP and apply to all small cutters, only Part C requires development as part of this project. The entire fire protection doctrine is included in Appendix E of this report for the sake of completeness. The doctrine specifies procedures for combating class A, B, and C fires in port and at sea in all types of compartments in the cutter. The scenarios are limited to those that are reasonable to expect, for example a class A fire in the Berthing Area, a class B fire in the Engine Room, and a class C fire in the electronics rack of the Chart Room. Only procedures, tactics, and equipment currently authorized by SHIPALT and in consonance with published Commandant policy in the Naval Engineers Manual (Commandant Instruction M9000.6B) and other official documents such as NSTM, Chapters 555 and 079 are incorporated in the new doctrine. [9,10,11] In addition, the new doctrine incorporates approved recommendations and comments from Coast Guard Headquarters (G-ENE) in response to the following previously submitted reports in the SCFP:

- Analysis of the Cutter Standard Repair Locker Inventory, December 1990.[12]
- Preliminary Fire Safety Analysis of Three Small Coast Guard Cutters, June 1991.[13]
- Fire Safety Analysis of Three Small Coast Guard Cutter Classes, July 1992.[14]
- Fire Safety Analysis of Six Small Coast Guard Cutters Classes, September 1993.[15]
- SCFP Project, November 1993.[3]

As stated before, the SFSEM was the analytical tool used to analyze the fire safety of the cutters studied in the SCFP. The primary objective of the fire safety analysis was to determine the baseline fire protection level for the cutter and compare it to the established FSOS on a compartment basis. Alternative enhancements to passive and/or active fire protection features were then evaluated for compartments which failed to meet minimum FSOS. Finally, a cost-benefit analysis of alternatives was performed to facilitate formulating recommendations for improving the fire safety of the Cutter.

The third objective is to evaluate the utility of the SFSEM for analyzing a ship in the preliminary design phase of construction. The SFSEM had been successfully used in 1987 to analyze the preliminary design of a new Icebreaker in the PIR Project.[4] However, the SFSEM has evolved into a more complex and sophisticated methodology since the PIR study was conducted. The SCFP was the impetus for significant improvements to the SFSEM. The following documents discuss some of these areas of improvement:

- CompuCon Letter to Mr. Robert Richards and Mr. David Beene dated 1 June 1992. [5] This letter provided a revised list of Compartment Use Indicators (CUI) with some adjusted frequency of Established Burning (EB) values based on an analysis of historical fire data. Thirteen limitations in the SFSEM were identified and recommendations for improvement were cited involving a broad range of topics from the assignment of input data values to algorithms for handling ship geometry inconsistencies. Several of these limitations are currently being addressed.

- CompuCon Letter to LT. Brian Dolph dated 18 March 1993. [7] This letter identified five concepts that would enhance the overall SCFP project. These concepts included the development of a fire protection doctrine for all nine classes of cutters analyzed, updating the Theoretical Basis of the SFSEM, fire growth model and fuel load refinement, cataloging of barrier materials, and a sensitivity analysis of the computerized implementation of the SFSEM, Ship Applied Fire Engineering (SAFE).

- CompuCon Letter to LT. Brian Dolph dated 25 May 1993. [8] This letter proposes grouping U.S. Coast Guard Cutters by size into two categories: small (less than 180') and large (180' and greater). This effectively adds three additional classes of cutters to the "small" cutter classification defined to be in scope for the SCFP. It also suggests a plan for developing fire protection doctrines for the remaining cutter classes.

The SFSEM has been used to analyze only the PIR in the preliminary design phase and this was prior to incorporating any of these improvements in the SFSEM. Therefore,

evaluating the utility of the enhanced SFSEM to analyze a ship in the preliminary design phase became an objective in this project.

1.4. TECHNICAL APPROACH

The SCFP is a multi-year project organized into four sequential phases:

- Literature Search
- Research and Analysis
- Test and Evaluation
- Develop Fire Protection Doctrine

The literature search has been conducted throughout the life of the project to identify new firefighting techniques and equipment suitable for use in small cutters. The research and analysis phase included a review of the Cutter Standard Repair Locker Inventory and a detailed fire safety analysis of the various classes of small Coast Guard Cutters using the SFSEM. The third phase was originally intended to test and evaluate the new techniques and equipment identified in the literature search. This was later modified to test and evaluate new techniques and equipment identified in two related projects:

- Alternatives to Fixed Fire Protection Systems
- SFSEM

Results from the test and evaluation phase will be documented in future reports as these tests are completed.

This report is one of two final reports in the SCFP Project; the other report summarizes the results of the fire safety analysis of the previous nine classes of small cutters studied in this project.[3] The fire protection doctrine for these nine classes of small cutters were included as appendices to that report. This report documents the results of the fire safety analysis and includes a proposed fire protection doctrine for the 175' WLM(R) Coastal Buoy Tender.

The basic technical approach used to develop the fire protection doctrines for the nine classes of small cutters was to start by analyzing the existing main space fire protection doctrine for each class of cutter. This provided a good starting point for developing procedures to combat class B fires in the machinery space. The new doctrine was then developed taking into account the feedback from Coast Guard Headquarters in previous phases of the SCFP. The new doctrine also incorporates procedures for class A and class C fires as well. Information from a variety of sources was utilized to develop these procedures and tactics including:

- Naval Ships Technical Manual, chapters 555 and 079, vols. 1-4 [10,11]
- Surface Ship Survivability Manual, NWP 62-1 (Rev C) [16]
- Cutter Casualty Control Manuals [17]
- Vessel Safety Manual [18]
- Marine Fire Prevention, Firefighting, and Fire Safety [19]

A thorough review of the existing main space fire doctrine revealed an extensive document that included basic information concerning fire science, tactics for fighting machinery space fires, and procedures promulgated by the Commandant that could be described as a philosophical approach to firefighting.[20] Moreover, it was organized into ten chapters that mixed this information throughout the document and included information applicable to a broad range of cutters. Therefore, it is difficult for a small cutter to tailor the document. In addition, a crew member transferred to another cutter was required to study the entire document to determine specific procedures applicable to his new unit. Accordingly, the technical approach was modified to deal with the limitations identified in the review.

The approach for developing the new doctrine was altered to reformat the existing doctrine into three parts. Part A incorporates basic information concerning fire science. This information applies to all cutters and rarely needs to be updated. Part B includes procedures and a philosophical approach to firefighting promulgated by the Commandant applicable only to small cutters. Large cutters would have a similar but different part B. Developing part B for large cutters is outside the scope of this project. Part C contains the specific tactics and procedures for combating class A, B, and C fires in the various compartments in the cutter. **Each cutter in the class will have to tailor part C of the new doctrine to account for any differences between themselves and the representative cutter studied to develop the doctrine for that class.** Such differences may exist due to uncompleted (or unauthorized) SHIPALTS and other changes inherent in the design of sub-classes. Crew members, who have been transferred from other small cutters, will only have to study Part C of the doctrine for their new ship. In addition, damage control personnel or others generally familiar with fire science will not have to study Part A.

Maintenance of the new fire protection doctrine is also simplified. The Commandant would be the appropriate authority responsible for updating and maintaining Parts A and B of the doctrine. The individual cutter would be responsible for tailoring, then maintaining, Part C in accordance with the guidance provided in Parts A and B.

2. SHIP FIRE SAFETY ENGINEERING METHODOLOGY

2.1. INTRODUCTION

The overall fire safety of a ship is not obvious. It is dependent upon many factors, including the vast number of fire scenarios that are possible. Furthermore, a ship is actually a fire safety system, because it demonstrates performance in all phases of the life cycle of fire from prevention through detection, containment, and extinguishment. To perform a fire safety analysis, a means is required to evaluate a ship's response to fires as a fire safety system. The analysis should be able to show how the fire safety system would perform if various alternatives such as better fire boundaries, improved fire detection, or more effective manual firefighting techniques were used. In other words, a means of modeling fires on ships is required which accounts for all the relevant aspects of fire and firefighting in an integrated framework. The SFSEM provides this integrated framework. The following sections furnish an overview of SFSEM and its implementing computer program, SAFE. The SFSEM and SAFE are discussed in detail in documentation available at the Coast Guard Research and Development Center in the Marine Fire and Safety Research Branch Library. [2, 21]

2.2. SFSEM FRAMEWORK

The ship, as a fire safety system, refers to the performance of a ship in all relevant aspects of fire from preventing fires in the first place, to responding to the flames and smoke produced from fires. In addition, the ability of passengers and crew to escape from a fire and the inherent ability of the ship's structure to withstand the fire's assault are also relevant considerations of a ship as a fire safety system. The SFSEM is designed to provide a comprehensive analysis of all aspects of the ship's performance as a fire safety system. It is designed in a modular fashion so that each of these considerations can be studied in isolation and so that the completed modules of the methodology can serve a useful purpose while others are being developed. The complete SFSEM consists of six major modules categorized as shown in Table 2.1.

Table 2.1 Framework of the SFSEM

A.	Performance Identification	
	1.	Fire Safety Objectives (FSO)
B.	Engineering Analyses	
	2.	Prevent Established Burning (EB)
	3.	Flame Movement
	4.	Smoke Movement
	5.	People Movement
	6.	Structural Frame

The Prevent EB and Flame Movement modules are incorporated in the SFSEM; the other four modules are under development at the present time or will be developed in the future. The following sections provide an overview of these six individual modules.

2.2.1. FIRE SAFETY OBJECTIVES MODULE

In order to analyze the performance of a ship as a fire safety system, there must be acceptable performance standards or criteria established by cognizant authorities. These criteria are referred to as Fire Safety Objectives (FSOS). Ideally, FSOS are established by cognizant authorities taking into consideration life safety, property protection and mission impairment. Cognizant authorities in the Coast Guard are the appropriate program and support managers in Coast Guard Headquarters. In the absence of such input, FSOS were established by the engineer/analyst using the process described in this section.

FSOS are designed to establish the performance standard for a fire safety system taking into account all aspects of fire including flame movement, smoke movement, people movement (egress for the occupants), and the ability of the structure to withstand the fire's assault. In the SFSEM, smoke movement, people movement, and structural analysis modules are not yet fully developed, therefore the FSOS are presently established considering flame movement only.

FSOS were established for the WLM(R) for each compartment utilizing the so-called traditional approach. It is the approach used over the past eight years in the fire safety analysis of eleven classes of Coast Guard Cutters. A number of limitations and drawbacks have been identified with the traditional approach, and there has been some discussion concerning the practicality and validity of establishing FSOS on a compartment basis [22, 23, 24]. Even with these minor concerns, the traditional approach has merit and is considered valid. A Fault Tree Analysis (FTA) approach to establish FSOS is currently under development but is not yet available. The following paragraphs describe the traditional approach in more detail.

FSOS are established for each compartment in the cutter that may be analyzed by SAFE. Currently, magazines, flammable liquid tanks, and helicopter hangars are not analyzed due to the inability of SAFE to deal with explosion hazards. All other compartments are rated for both Magnitude of Acceptable Loss (MAL) and Frequency of Acceptable Loss (FAL). The MAL is established by assigning a rating to each of the following four factors and then weighting these factors to determine an overall rating for the compartment:

- Life Safety (LS)
- Property Protection (PP)
- Primary Mission (PM)
- Secondary Mission (SM)

The weighting factors are different for each module in the SFSEM. For example, in the flame movement module, damage from flames affects the primary mission of the ship more than it causes life safety concerns. Whereas considering the effects of smoke, life safety will be the primary concern compared to the property damage. Thus the weighting factors for the four factors are adjusted for each module in the SFSEM. The weighting factors used to assign a MAL rating to each compartment in the WLM(R) considering flame movement only are shown in the following expression:

$$MAL = 0.1*LS + 0.3*PP + 0.4*PM + 0.2*SM$$

The MAL rating for each factor is permitted to be one of the following four integer values:

1. Established Burning (EB) is not acceptable
2. EB is acceptable but Full Room Involvement (FRI) is not
3. FRI is acceptable but Compartment Burnout (CBO) is not
4. CBO is acceptable

A rating of 1-4 is assigned to each factor for each compartment, then the overall MAL rating is calculated according to the algebraic expression shown above and the truncated MAL rating is assigned to the compartment. For example, if the results of the calculation is 3.37, a MAL of 3 is assigned. The results for the WLM(R) are tabulated in Appendix B in Table B.3.1.

The ratings are assigned for each factor using engineering judgment and considering the effect flame movement has on each factor. Compartments whose total loss (CBO) would not significantly affect the ship's primary or secondary mission are typically assigned a rating of 4 for factors PM and SM. For example, most sanitary spaces, gear lockers, passageways, voids, water tanks, ladders, cofferdams, and certain storerooms, if totally lost, would not prevent the ship from performing its primary or secondary mission. Note, a compartment may contain a significant fuel load and contribute materially to the spread of a fire, but if its loss does not significantly affect the ship's mission, it receives a rating of 4. At the other extreme, flammable materials storage lockers, paint lockers, and other compartments containing extremely flammable materials representing a significant fire hazard are normally assigned a rating of 1 for the factors PM and SM.

The balance of the compartments are normally assigned a rating of 2 or 3 for the factors PM and SM. In general, if the compartment contains equipment vital to the ship's primary or secondary mission, and if its loss would likely result in the ship aborting its patrol and returning to homeport for repairs, it would be assigned a 2. On the other hand, if the compartment's loss would degrade, but not prevent, the ship's ability to perform its mission, it would receive a 3 rating. Examples of compartments typically rated 2 for the factors PM or SM are the Engine Room, Bridge, and Galley. Berthing Areas, Ship's Offices and Labs/Workshops are typically assigned a 3 rating for the factors PM and SM.

A compartment's cost to replace is the primary consideration for assigning a rating to the property protection (PP) factor. Obviously, Engineering Spaces such as the Engine Room, Emergency Generator Room, Auxiliary Machinery Rooms contain very expensive machinery not only from an acquisition point of view but the costs involved in the labor to install and align the equipment is significant as well. Thus these spaces are typically assigned a rating of 2 for the PP factor. A rating of 1 is assigned for those spaces such as paint lockers and flammable materials storage lockers for the property protection factor that would undoubtedly lead to additional property damage in other adjacent spaces. A

rating of 4 is assigned for the PP factor to those spaces whose total loss would be considered minimal (compared to other spaces). Finally, a rating of 3 is assigned for the PP factor to those compartments whose cost is not minimal but is considered far less than major engineering spaces. Examples of spaces assigned a 3 rating for the PP factor include the Galley, Scullery and spaces with some minor machinery such as sewage machinery spaces and potable water equipment rooms.

Ratings for the life safety (LS) factor take into account the likelihood that personnel will be injured by the fire (not the smoke or toxic gases). This probability is affected by the likelihood that the space will be occupied, the accessibility of the space, the quantity of personnel likely to be in the space, and the likelihood that the occupants will be sleeping. Thus spaces such as the Paint Locker where personnel would be in danger even if EB occurs are assigned a rating of 1 for the LS factor. If EB can occur but personnel are not likely to be in serious danger unless FRI occurs receive a rating of 2 for the LS factor. If FRI can be tolerated but the entire compartment would have to be lost before personnel are in danger of being injured, a rating of 3 would be appropriate for the LS factor. Finally, if a compartment can be totally lost and still not endanger personnel, a rating of 4 can be assigned to the LS factor. After a rating has been assigned to all four factors the overall MAL rating for the compartment is calculated. This value is then used in the calculation for the FAL as described in the next paragraph.

The FAL is coupled to the MAL. For example, it may be considered acceptable to lose a compartment with a MAL = 4 once a year but compartments with a MAL = 1 may be lost only once in a ship's lifetime (30 years). Based on MAL and FAL ratings established by engineering judgment for similar compartments in several classes of cutters, a correlation between MAL and FAL was determined by fitting a curve to the data points. The following algebraic relationship expresses this correlation and is now used to establish the FAL based on the MAL rating for each compartment:

$$FAL = 32.25 - (1.766 * MAL) - (0.214 * MAL^2) - (0.222 * MAL^3)$$

2.2.2. ENGINEERING ANALYSES MODULES

Engineering analyses comprise the other five modules in the SFSEM. Prevent EB is designed to analyze the actions taken to prevent a fire from occurring in the first place, and the initial actions taken by a person discovering a fire in its incipient stage. Flame Movement, Smoke Movement, People Movement, and Structural Frame are modules that analyze the ship's ability to respond to a fire that has reached EB. Each of these analyses is designed to provide information that will allow a comparison of the ship's performance relative to the established FSOS. The following sections provide an overview of each of these modules.

2.2.2.1. Prevent Established Burning Module

In fire protection engineering terms, EB defines the point when radiational feedback to the fuel bed begins to predominate as the heat transfer mode and the heat release rate of the pyrolizing fuel will rapidly increase if proper conditions for combustion exist. From a layman's perspective, it is the smallest flame one would worry about. A cigarette lighter flame would be a concern in a compartment such as the paint locker, but a flame would have to be considerably larger to be a concern in a cargo hold. The specific fire size that defines EB can thus range in size from a spark to a flame height of 4 feet or more. A 10 inch high flame is commonly accepted as the smallest flame on a ship that constitutes EB.

The Prevent EB module analyzes the probability of EB occurring in a target compartment. There are two basic approaches to accomplish this analysis. The first approach calls for evaluating the probability of each event that would lead to EB including overheating, ignition, and growth from ignition to EB. The other approach is simply to analyze historical records if sufficient data exists. Fire safety analyses of Coast Guard Cutters to date have utilized historical records to establish the frequency of EB since adequate data from the U.S. Naval Safety Center and U.S. Coast Guard Headquarters is available for each type of compartment aboard ship.

2.2.2.2. Flame Movement Module

If a fire grows beyond EB, the goal of shipboard firefighting is to limit the spread of the fire to the room of origin. If the fire breaches the compartment boundaries (or barriers) in the room of origin the fire may spread to involve adjacent compartments.

Thus, from the perspective of flame movement, fire spreads from compartment to compartment by attacking and destroying the barriers separating the compartments. Fire will continue to spread if there is adequate fuel to sustain fire growth. The SFSEM first evaluates the probability of extinguishing the fire in a room of origin; then it considers the probability of the compartment barriers successfully limiting the fire from spreading to adjacent compartments. Finally, it evaluates the probability of extinguishing the fire in the adjacent compartments, then the adjacent compartment's barriers are evaluated and so on. This process is repeated for every possible room of origin and every possible fire path until the probability of limiting the fire is 100% or until the user-specified time has elapsed, whichever comes first. Results are accumulated and compared to FSOS. The results identify areas where fire protection systems need to be improved and where they can be reduced and still achieve desired levels of fire protection. A key point in the flame movement module of the SFSEM is that the probabilities involved are determined based on engineering judgment or degree of belief of the analyst. While the Methodology is fundamentally probabilistic, certain aspects in fire science lend themselves to deterministic solutions, and deterministic algorithms are incorporated wherever sufficient data exists to validate them. The philosophy also considers the fact that the human mind is limited in the number of factors it can integrate simultaneously. The framework of the SFSEM breaks all events into smaller subevents so that the analyst can focus his or her engineering judgment on relatively few factors, while the computer programs carry out the extensive calculations necessary to aggregate the results.

2.2.2.3. Smoke Movement Module

All fires produce smoke and toxic gases as products of combustion. In addition, certain firefighting agents create toxic gases in a fire or significantly reduce available oxygen. The obscuration from the smoke and the untenable atmosphere from the toxic gases more often result in a life-threatening situation than the flames themselves. An analysis of the smoke movement in a fire is therefore vitally important in determining the ship's performance relative to life safety objectives. Unfortunately, the analysis of smoke movement in a ship with its installed ventilation systems is extremely complex. Considerable research has been devoted to smoke movement by fire protection engineers in the academic as well as research and development communities. The smoke movement module will be the next module integrated into the SFSEM.

2.2.2.4. People Movement Module

In the event of a fire emergency on a ship, passengers and off-duty crew have to proceed to areas of refuge. On-duty crewmen in certain spaces such as the Bridge and Engineering Control Center cannot evacuate due to the need to operate the ship's propulsion and navigation systems. In wartime, battle stations also remain occupied during a fire due to the need to defend the ship and operate the ship's weapons systems. Consequently, certain compartments require fire protection systems adequate to protect occupants who cannot evacuate for one reason or another. The people movement module will be designed to analyze egress routes to areas of refuge and evaluate the adequacy of fire protection systems for defending people in place. This module will be developed and integrated into the SFSEM in the future.

2.2.2.5. Structural Frame Module

Watertight bulkheads and decks on ships provide the necessary segregation for adequate protection against progressive flooding. The watertight compartments thus created are further subdivided with non-structural bulkheads to provide segregation of ship functions and accommodate the ship's missions. Most watertight boundaries in ships are steel to provide the necessary structural strength to resist the hydrostatic forces that may be encountered. The structural collapse of steel bulkheads and decks in the first hour or so of a fire is unlikely. However, some ships such as hydrofoils, fast patrol boats, surface effect ships and other weight-critical vessels are constructed of aluminum. This material loses structural strength at relatively low temperatures compared to steel. The structural frame module is intended to analyze the effects of fire on the structural members of the ship. This module will also be developed and integrated into the SFSEM in the future.

2.2.3. SFSEM APPLICATIONS

The flame movement module of the SFSEM is a probabilistic-based risk analysis methodology. This means that the results are based primarily on probabilities determined by engineering judgment of the engineer/analyst as opposed to deterministic calculations of conditions precisely known. Therefore, the results are the most useful when the analyst uses the methodology to compare outcomes on a relative basis. Analyzing competing

preliminary designs to identify the best design with respect to fire safety is an example of such a potential application. It is also appropriate to compare, on the same ship, the effectiveness of different fire protection alternatives. In the case of the WLM(R) the SFSEM was intended to be used to suggest improvements to the preliminary design before proceeding to the detailed design.

The SFSEM has been used in the past to analyze the preliminary fire safety design of the PIR. It has also been used extensively in the SCFP to analyze the fire safety design of nine classes of small U. S. Coast Guard Cutters. This report documents the analysis of the proposed fire safety design of a new class of U.S. Coast Guard Coastal Buoy Tenders. It has been demonstrated therefore that the SFSEM has utility to analyze proposed, as well as existing, fire safety designs of ships. The following sections describe the past as well as potential applications for the SFSEM.

2.2.3.1. Fire Safety Design Analysis

The SFSEM permits an evaluation of individual fire protection components within a ship. It can compare alternative fire protection measures against a baseline or in a relative sense to each other. The basic flowchart for this process is illustrated in Figure 2.1. The SFSEM can be used to compare alternative fire protection components that are in the same category such as evaluating the effectiveness of different firefighting agents. Its true value, however, lies in its ability to compare heretofore incomparable entities such as evaluating the relative effectiveness of a barrier and a firefighting technique. This sort of comparison is especially useful to answer "what-if" questions often raised by decision-makers. Note that actual or proposed components can be evaluated on actual or proposed ships. Furthermore the SFSEM and the reports generated by SAFE provide the necessary documentation to support a serious study of the fire safety of these vessels.

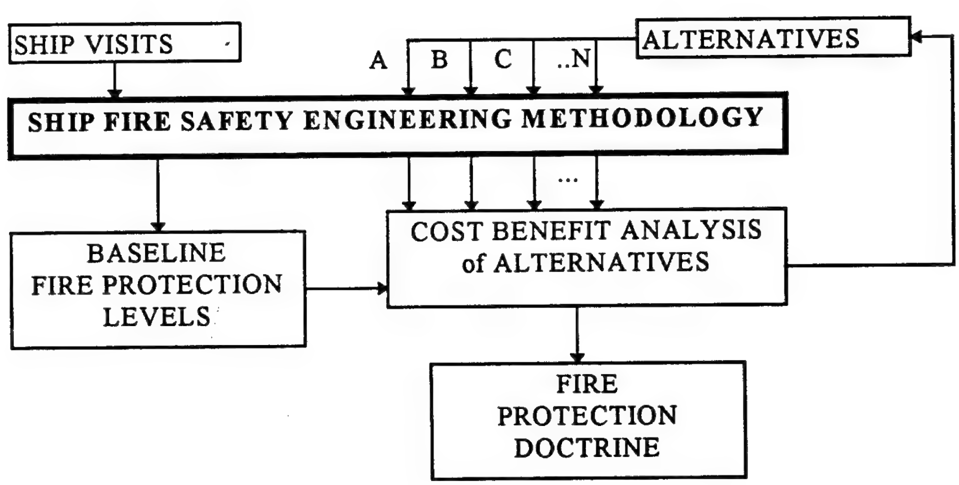

Figure 2.1 Role of the SFSEM in Fire Safety Design Analysis

2.2.3.2. Fire Investigations

The focus of fire investigations is usually a search for the cause or origin of the fire and frequently includes an investigation for negligence or dereliction of duty. Certainly, the loss of valuable property and lives warrants an investigation and a determination of responsibility, but the performance of the ship as a fire safety system is often overlooked. Moreover, there has been a lack of analytical tools with which to assess this performance. The SFSEM is not the proper tool to conduct a forensic type of fire reconstruction analysis. There are deterministic computer fire models which are more appropriate for this type of analysis. However, the SFSEM can be used to analyze the possible fire paths compared to the actual fire path to gain insight into the ship's response to the fire. Furthermore, most ships are one vessel in a class of similar ships. An analysis of a fire may yield valuable information which would benefit the rest of the class.

2.2.3.3. Future Applications

In the future, the SFSEM may be used for equivalency determinations. The SFSEM provides the ability to quantify the contribution of fire protection features such as passive, automated, or manual firefighting features to achieve FSOS. Therefore, the means exists to verify an equivalent feature. For example, installing an automated fire protection system such as a sprinkler may be determined equivalent to the passive fire protection currently provided by the existing watertight boundaries which act as fire boundaries. The SFSEM does not take into account flooding, therefore removing an existing bulkhead may be compensated by installing the sprinkler system <u>for the purposes of fire safety</u>, but flooding the "larger" compartment thus created may result in the ship sinking. The SFSEM only considers fire safety related issues.

The effectiveness of damage control teams in response to shipboard fires varies considerably from ship to ship. Even within a ship, the response can vary between daytime and nighttime and especially over a period of time following firefighting team training. The evaluation of the time between initial notification of the Bridge and the agent application is one of the significant variables. This variable could be used as the basic standard of measurement for damage control firefighting teams. Evaluation of this base measure, compared with other measures of firefighting agent delivery, can provide evaluation of levels of fire protection for different compartments within the ship or a comparison of different ships within the same class. This would serve to point out areas where damage control training was deficient. The SFSEM could also be used in a similar manner to evaluate the effectiveness of the ship's fire protection doctrine.

2.3. SAFE

SAFE employs both AutoCAD and an external database in order to organize the large amounts of data required to perform a fire safety analysis, to provide a user-friendly and manageable means of data entry, and to display the results in a meaningful manner. The following sections provide an overview of SAFE.

2.3.1. OVERVIEW

The SAFE programming system automates portions of the SFSEM. It is actually an integrated series of programs requiring engineering evaluations, ship geometry, and ship features as input. SAFE enables a person to describe the layout of a ship through AutoCAD, enter data values for compartments and barriers into a database, and run a probabilistic fire model on a ship. These data values, as well as results of running the probabilistic model, can be output in tabular or graphical form. Version 2.1A of SAFE was used in the WLM (R) analysis. Versions 2.1 and 2.0 were used to analyze the nine classes of small cutters, and Version 1.0 was used in the PIR study. The SAFE User Manual provides the details necessary to use SAFE to conduct a fire safety analysis on a ship. [21] The analyst should also be a fire protection engineer with shipboard experience and with an understanding of the SFSEM.

2.3.2. AUTOCAD

SAFE requires an accurate representation of the ship's geometry in order to determine connectivity between compartments and thus predict fire growth through these compartments. To provide this geometry, the coordinates of the corner points ("vertices") of each compartment's deck, the compartment elevation, and the compartment height are needed. SAFE utilizes AutoCAD as a tool for drafting a simplified version of the general arrangement deck plans of the ship so this information can be obtained. AutoCAD is also used to tailor default values assigned by the database and to display graphic results of the analysis.

2.3.3. DATABASE

The database is loaded, using information from the AutoCAD drawing and database entry screens, with all the values it needs to run the probabilistic model. General ship information is entered through a database screen, then the ".dxf" (drawing exchange format) files created in AutoCAD are used to calculate the ship geometry. Once the ship geometry is complete, information from the ship visit forms are entered. Certain fire parameters are assigned default values, and AutoCAD permits tailoring these default values. Database reports are available to display fire parameters assigned to each compartment and barrier.

2.3.4. PASCAL PROGRAMS

Integrated into SAFE are numerous Pascal programs which provide three critical functions of the SFSEM:

- Connectivity Generation. Based on the AutoCAD drawings, SAFE determines the connectivity between compartments. Specifically, it determines which segments of bulkheads and decks are in common between compartments. Modelling this correctly is important because the SFSEM relies on the principle that fire spreads from one compartment to another by attacking and destroying the barriers between compartments.

- FRI Time and Heat Release Rate Calculations. The FRI time algorithm utilizes the Beyler/Peatross algorithm. The coefficients for this algorithm are based on full-scale shipboard testing at the Fire and Safety Test Detachment in Mobile, Alabama. The post-FRI heat release rate calculation is based on compartment ventilation assuming "worst case" stoichiometric burning.

- Probabilistic Modeling. A run of the fire model begins with a compartment which has experienced ignition and fire growth to the point where the fire size meets the definition of "EB". At the point when EB is reached the clock is set to time 0 (minutes) in the compartment referred to as the room of origin. The fire is allowed to grow until FRI is achieved in the room of origin or until the flames are limited by passive, automated or manual means prior to FRI. The variables in the equation that describes fire growth in the pre-FRI fire growth regime are explained in the Theoretical Basis of the SFSEM [2]. If FRI is achieved however, the model then calculates and accumulates the heat energy impact on the barriers in the room of origin and determines the probability of failure for each barrier from the catalog of Tbar and Dbar curves for barrier materials. Heat energy impact is calculated in the post-FRI fire growth regime according to the model for heat release rate assuming stoichiometric burning (adequate oxygen to support combustion of all available fuel). If a barrier failure occurs, EB is established in the adjacent compartment and the fire growth cycle is started again. This space-barrier progression is allowed to continue until the fire is limited or until a predetermined, user-specified, end time has elapsed. In this space-barrier propagation, the probabilistic model builds a set of fire paths from each possible room of origin and accumulates results so that the compartments may be rank ordered in their performance as "targets" of the fire compared to the established FSOS.

2.3.5. COMPARISON OF SAFE VERSIONS 2.1 AND 2.1A

Version 2.1 of SAFE was used in the SCFP with the exception of the WLM(R) analysis. Three major improvements were incorporated into version 2.1 that resulted in the creation of version 2.1A used in the WLM(R) analysis:

- The coefficients in the Beyler-Deal algorithm to calculate time to FRI were improved based on full scale tests at the Coast Guard Fire Safety Test Detachment in Mobile, AL. The new algorithm is referred to as the Beyler-Peatross algorithm for FRI Time and reflects a more accurate determination of FRI Time for thermally thin bulkheads such as the steel bulkheads encountered on board ship.

- In version 2.1, when a barrier is declared destroyed the probability of barrier failure (Tbar and Dbar) did not continue to increase over time. In the worse case definition of barrier failure a barrier is considered destroyed when the probability of durability failure is greater than 0.1. The improved version of SAFE continues to permit increased probabilities of Tbar and Dbar until the probability of Dbar failure equals 1.0.

- Fuel is depleted from a compartment which has reached FRI at the post-FRI rate of heat release each minute of the model run. In version 2.1A additional fuel is depleted to account for the heat loss to adjacent compartments through failed barriers.

A comparison of FRI Times for all WLM(R) compartments, as calculated by the two versions of SAFE, is shown in Table 2.2. These results show that the elapsed time from EB to FRI is the same or less in version 2.1A than in version 2.1. In a few compartments such as the Engineer's Storeroom, Elec/Elex Storeroom, Mess Room and Machine Shop the FRI times are significantly lower in version 2.1A than in version 2.1. Lower FRI times indicate less elapsed time until untenable conditions are reached in a compartment. As shown in Table 2.3, RLFS for the baseline data set generally increase indicating lower fire safety levels using version 2.1A compared to 2.1. Thus, version 2.1A will predict lower levels of fire safety and is considered more accurate than version 2.1.

Table 2.2 WLM(R) FRI Times with SAFE Versions 2.1 and 2.1A (1 of 2)

Plan ID	Compartment Name	Version 2.1 FRI Time (Min.) XRAY	Version 2.1 YOKE	Version 2.1 ZEBRA	Version 2.1A FRI Time (Min.) XRAY	Version 2.1A YOKE	Version 2.1A ZEBRA
CUI=AA (Cargo Holds)							
2-24-0-AA	CARGO HOLD	4	4	4	3	3	3
CUI=AG (Gear Lockers)							
2-4-1-A	CHAIN LKR	∞	∞	∞	∞	∞	∞
2-4-2-A	CHAIN LKR	∞	∞	∞	∞	∞	∞
1-0-0-Q	BOATSWAIN STRM	6	6	6	5	5	5
1-61-1-Q	REPAIR LKR	1	1	1	1	1	1
1-76-1-A	CLEANING GEAR LOCKER	1	1	1	1	1	1
01-53-1-A	CLEANING GEAR LOCKER	1	1	1	1	1	1
01-67-1-A	LINEN LOCKER	1	1	1	1	1	1
01-70-1-Q	BOAT LKR	2	2	2	1	1	1
01-83-4-Q	TRASH LKR	3	3	3	3	3	3
02-61-1-Q	PFD LKR	2	2	2	2	2	2
02-61-2-Q	PFD LKR	2	2	2	2	2	2
02-68-1-Q	BATTERY LKR	1	1	1	1	1	1
CUI=AS (Storerooms)							
3-47-1-Q	ENGRS STRM	∞	∞	∞	6	6	6
3-52-1-Q	ELEC/ELEX STRM	6	6	6	1	1	1
1-77-1-A	SODA LKR	3	3	3	3	3	3
CUI=C (Ship Control, Communication)							
3-52-0-C	ENGINEERING CONTROL CTR	5	5	5	2	2	2
01-50-0-C	BUOY DECK CONTROL ROOM	4	4	6	4	4	6
02-52-0-C	PILOTHOUSE	5	5	5	5	5	5
CUI=EM (Main Propulsion-Mechanical)							
3-6-0-E	BOW THRUSTER ROOM	3	3	3	2	2	2
3-61-0-E	MAIN ENGINE ROOM	3	3	3	3	3	3
CUI=K (Hazardous Material Storage)							
1-6-3-Q	PAINT LKR	2	2	2	2	2	2
CUI=L1 (Senior Officer's Cabin)							
01-52-1-L	CO CABIN	5	5	5	2	2	2
01-62-1-L	CO SR	2	2	2	2	2	2
CUI=L2 (Officer/CPO Quarters)							
01-52-2-L	CPO SR (1)	2	2	2	2	2	2
01-61-2-L	CPO SR (1)	2	2	2	2	2	2
CUI=L5 (Crews Berthing)							
1-79-1-L	ENLISTED SR (4)	2	2	2	2	2	2
1-79-2-L	ENLISTED SR (3+1)	2	2	2	2	2	2
01-68-2-L	PO SR (2+2)	2	2	2	2	2	2
01-76-0-L	ENLISTED SR (4)	2	2	2	2	2	2
01-76-2-L	ENLISTED SR (2+2)	2	2	2	2	2	2
CUI=LL (Wardroom/ Mess/ Lounge Area)							
1-61-0-L	MESS ROOM	11	11	11	6	6	6
CUI=LP (Passageway/Staircase/Vestibule)							
3-35-0-Q	PASSAGE	∞	∞	∞	∞	∞	∞
1-52-0-L	PASSAGE	∞	∞	∞	∞	∞	∞
1-52-1-L	COMPANIONWAY	∞	∞	∞	∞	∞	∞
1-79-0-L	COMPANIONWAY	∞	∞	∞	∞	∞	∞
1-79-01-L	PASSAGE	∞	∞	∞	∞	∞	∞
01-55-0-L	PASSAGE	∞	∞	∞	∞	∞	∞
01-61-1-L	COMPANIONWAY	∞	∞	∞	∞	∞	∞
02-58-1-L	LADDER	∞	∞	∞	∞	∞	∞

Table 2.2 WLM(R) FRI Times with SAFE Versions 2.1 and 2.1A (2 of 2)

Plan ID	Compartment Name	Version 2.1 FRI Time (Min.) XRAY	YOKE	ZEBRA	Version 2.1A FRI Time (Min.) XRAY	YOKE	ZEBRA
CUI=LW	(Sanitary Spaces)						
1-83-0-L	ENLISTED WR,WC&SH	∞	∞	∞	∞	∞	∞
1-83-2-L	ENLISTED WR,WC&SH	∞	∞	∞	∞	∞	∞
01-58-2-L	CPO WR,WC	∞	∞	∞	∞	∞	∞
01-66-1-L	CO WR,WC SHR	∞	∞	∞	∞	∞	∞
01-74-2-L	ENLISTED WR,WC&SH	∞	∞	∞	∞	∞	∞
01-83-2-L	ENLISTED WR,WC&SH	∞	∞	∞	∞	∞	∞
CUI=QA	(Aux Machinery Spaces)						
3-15-0-E	HYDRAULIC EQPT RM	3	3	3	2	2	2
3-42-1-Q	POTABLE WATER EQPT RM	2	2	2	2	2	2
3-79-0-Q	PUMP ROOM	3	3	3	2	2	2
3-88-0-E	PROPULSION THRUSTER RM	3	3	3	3	3	3
CUI=QE	(Emergency Aux Generator Rm)						
02-68-2-E	EMERGENCY GEN RM	2	2	2	2	2	2
CUI=QF	(Fan Room)						
02-52-0-V	VOID	∞	∞	∞	∞	∞	∞
CUI=QG	(Galley/ Pantry/ Scullery)						
1-61-2-Q	GALLEY	2	2	2	2	2	2
1-76-2-Q	SCULLERY	2	2	2	1	1	1
CUI=QL	(Laundry)						
1-52-3-Q	CHANGE RM	3	3	3	2	2	2
1-58-1-Q	LAUNDRY	2	2	2	1	1	1
CUI=QO	(Office Spaces)						
1-52-2-Q	SHIP'S OFFICE	1	1	1	1	1	1
1-57-2-Q	ENG OFFICE AND DC CENTRAL	1	1	1	1	1	1
02-61-0-C	CHART ROOM	1	1	1	1	1	1
CUI=QS	(Shops)						
3-42-0-Q	MACHINE SHOP	∞	∞	∞	8	8	8
3-57-1-Q	ELEC SHOP	8	8	8	5	5	5
1-6-1-Q	SERVICE LKR	2	2	2	2	2	2
1-6-2-Q	ATON SHOP	2	2	2	2	2	2
CUI=TU	(Stacks/ Engine Uptakes)						
1-70-1-Q	UPTAKE	2	2	2	2	2	2
02-70-0-Q	STACK	2	2	2	2	2	2
CUI=V	(Voids/ Cofferdams)						
3-0-0-V	FOREPEAK	∞	∞	∞	∞	∞	∞
3-15-0-V	VOID	∞	∞	∞	∞	∞	∞
3-24-0-V	VOID	∞	∞	∞	∞	∞	∞
3-35-0-V	VOID	∞	∞	∞	∞	∞	∞
3-4-0-V	VOID	∞	∞	∞	∞	∞	∞
3-42-0-V	VOID	∞	∞	∞	∞	∞	∞
3-52-0-V	VOID	∞	∞	∞	∞	∞	∞
3-6-0-V	VOID	∞	∞	∞	∞	∞	∞
3-79-0-V	VOID	∞	∞	∞	∞	∞	∞
3-88-0-V	VOID	∞	∞	∞	∞	∞	∞
01-51-0-V	VOID	∞	∞	∞	∞	∞	∞
CUI=W	(Water Tank)	∞	∞	∞	∞	∞	∞
3-35-1-W	BALLAST TANK	∞	∞	∞	∞	∞	∞
3-35-2-W	BALLAST TANK	∞	∞	∞	∞	∞	∞
3-81-1-W	GRAY WTR HOLDING TNK	∞	∞	∞	∞	∞	∞
2-44-0-W	FRESH WATER TANK	∞	∞	∞	∞	∞	∞

Table 2.3 WLM(R) Baseline Results with SAFE Versions 2.1 and 2.1A								
			XRAY,	In Port	YOKE,	In Port	YOKE,	At Sea
Scenario Description	Plan ID	Compartment Name SAFE Version	2.1	2.1A	2.1	2.1A	2.1	2.1A
"I", "A", "M"	1-6-3-Q	Paint Locker	0.39	0.41	0.07	0.07	0.07	0.07
	02-61-0-C	Chart Room	0.23	0.38	0.20	0.33	0.20	0.33
	02-52-0-C	Pilothouse	0.03	0.15	0.03	0.15	0.03	0.15
	02-70-0-Q	Stack	0.15	0.21	0.17	0.21	0.17	0.21
	1-70-1-Q	Uptake	0.13	0.16	0.14	0.17	0.14	0.17
	02-68-2-E	Emergency Generator Room	0.11	0.16	0.12	0.15	0.12	0.15
	1-61-0-L	Mess Room	0.15	0.15	0.11	0.12	0.11	0.12
"I" and "A"	1-6-3-Q	Paint Locker	0.83	0.84	0.08	0.08	0.08	0.08
	02-61-0-C	Chart Room	0.76	0.97	0.58	0.77	0.58	0.77
	02-52-0-C	Pilothouse	0.10	0.38	0.10	0.37	0.10	0.37
	02-70-0-Q	Stack	0.36	0.46	0.43	0.50	0.43	0.50
	1-70-1-Q	Uptake	0.25	0.29	0.28	0.32	0.28	0.32
	02-68-2-E	Emergency Generator Room	0.22	0.31	0.24	0.32	0.24	0.32
	1-61-0-L	Mess Room	0.36	0.35	0.29	0.34	0.29	0.34
"I" and "M"	1-6-3-Q	Paint Locker	0.49	0.52	0.07	0.07	0.07	0.07
	02-61-0-C	Chart Room	0.63	0.89	0.33	0.54	0.33	0.54
	02-52-0-C	Pilothouse	0.04	0.23	0.04	0.23	0.04	0.23
	02-70-0-Q	Stack	0.45	0.60	0.37	0.44	0.37	0.44
	1-70-1-Q	Uptake	0.37	0.43	0.38	0.43	0.38	0.43
	02-68-2-E	Emergency Generator Room	0.33	0.49	0.28	0.40	0.28	0.40
	1-61-0-L	Mess Room	0.58	0.61	0.25	0.31	0.25	0.31
"I" Only	1-6-3-Q	Paint Locker	1.06	1.09	0.08	0.08	0.08	0.08
	02-61-0-C	Chart Room	2.65	3.08	0.94	1.22	0.94	1.22
	02-52-0-C	Pilothouse	0.19	0.68	0.16	0.61	0.16	0.61
	02-70-0-Q	Stack	1.31	1.65	0.77	0.88	0.77	0.88
	1-70-1-Q	Uptake	0.63	0.73	0.65	0.72	0.65	0.72
	02-68-2-E	Emergency Generator Room	0.89	1.26	0.62	0.89	0.62	0.89
	1-61-0-L	Mess Room	1.46	1.56	0.86	1.24	0.86	1.24

2.4. FIRE SAFETY ANALYSIS PROCEDURE

A nine step procedure has been developed and refined over the course of conducting previous analyses. Prior to conducting the analysis, it is necessary to obtain the ship's general arrangement drawings in AutoCAD. This may require a preliminary ship visit to obtain the ship's geometry to assist the analyst in decisions regarding modeling the ship's geometry in AutoCAD. Once the ship has been modeled in AutoCAD, the following nine step procedure is used to perform a complete fire safety analysis:

1. Load Database With Ship's Geometry
2. Conduct Ship Visit
3. Load Safe Input Values
4. Calculate FRI Times and Post-FRI Heat Release Rates
5. Run Probabilistic Model
6. Analyze Baseline Results
7. Analyze Fire Protection Alternatives
8. Conduct Cost-Benefit Analysis
9. Document Results

These nine steps are discussed in greater detail in the following sections.

2.4.1. LOAD DATABASE WITH SHIP'S GEOMETRY

Load the ship's geometry into the database and generate the ship visit forms. The ship visit forms are a series of spreadsheets with the compartments categorized by "compartment use indicator" (CUI) as rows and the required input data as columns. This data includes, but is not limited to:

- Information concerning the cutter's compartmentation
- Thermal and physical data for the bulkheads and deck materials
- Location and identification of firefighting and fire detection equipment
- Ventilation details including compartments served
- Estimates of fuel loads and distribution
- Various probabilities of flame limitation in each compartment

2.4.2. CONDUCT SHIP VISIT

It is essential that the engineer/analyst personally visit the ship. During the ship visit, the engineer/analyst:

- Completes the ship visit forms and verifies all information on the forms for accuracy.

- Photographs compartments to document fuel loads, unusual fire protection features, accesses, egress routes, ventilation openings, etc.

- Ideally, observes an "in port" fire drill and notes the time to set condition ZEBRA. If it is impractical to observe an actual fire drill, the characteristic time to set ZEBRA may be obtained from the ship's records.

- Obtains copies of the ship's main space fire doctrine, casualty control manual, and compartment check-off lists if these documents were not previously collected.

- Discusses with the Commanding Officer and Operations Officer the various missions of the ship and which compartments contain equipment which supports these missions. This information aids in establishing realistic FSOs.

- Discusses with the Engineering Officer and Damage Control Assistant (DCA) the state of the crew's firefighting training. In addition, the general condition of the ship (well maintained and clean or not), and the overall attitude and sense of pride in the ship the crew displays is noted. This information is used in the determination of certain input values which are assigned by engineering judgment.

The quality of the fire safety analysis is directly proportional to the quality of the information collected during the ship visit. Typical small cutter ship visits requires two working days for two engineer/analysts. Large cutters may require additional time.

As in the case of the WLM(R), an actual ship may not exist to visit. In this event, the engineer/analyst should visit a similar ship (in size, design, and mission) to aid the engineer's judgment in predicting what the input values will be once the ship is built. In addition, the Circular of Requirements (COR) and information provided by the shipyard, can augment the knowledge gained by visiting a similar ship.

2.4.3. LOAD SAFE INPUT VALUES

Enter the information from the ship visit forms into SAFE. This step includes refining the ship's geometry with any new information gathered during the ship visit, determining/calculating all required fire parameters, performing the data entry of the information on the ship visit forms and verifying the accuracy of the data entry. The values now in the database comprise the "baseline data set" for the ship. This permits discrimination from data associated with hypothetical alternatives that may be analyzed later in the analysis.

2.4.4. CALCULATE FRI TIMES AND POST-FRI HEAT RELEASE RATES

After all input values have been assigned, the FRI time and post-FRI heat release rates are calculated for each compartment. FRI times may be reviewed and input values adjusted if necessary prior to recalculation of FRI.

2.4.5. RUN PROBABILISTIC MODEL

Once the database has been loaded with all required input, the probabilistic model is run on the baseline data set using standard scenarios. A standard scenario in SAFE includes user-defined parameters such as material condition of readiness, ship location, firefighting configuration, barrier failure criteria, simulation run time, etc. Standard scenarios are established to describe operating conditions for the cutter over the majority of its life cycle.

A cutter is typically in material readiness condition XRAY (all access closures, valves and fittings marked "X" closed) or YOKE (all access closures, valves and fittings marked "X" or "Y" closed). Condition ZEBRA (all access closures, valves, and fittings marked "X," "Y," or "Z" closed) is set only in emergencies such as fire, collision, or enemy attack. SAFE simulates the setting of condition ZEBRA during a model run after a calculated "time to set ZEBRA" has been reached. The ship is located either in port or at sea. The firefighting configuration includes the three lines of defense ("I" probability that the fire will self-extinguish; "A" probability that an automated/fixed fire protection system will limit the fire, and "M" the probability that the manual firefighting efforts of the crew will extinguish the fire). Standard scenarios are thus established that include different combinations of these parameters that describes the cutter over its life cycle. The standard scenarios are shown in Table 2-4 as Scenarios 1-3.

Table 2.4 STANDARD AND NON-STANDARD SCENARIOS			
STANDARD SCENARIOS			
Scenario #	**1**	**2**	**3**
Readiness **Location** **Configuration**	**X-RAY** **IN-PORT** **I, A & M**	**YOKE** **IN-PORT** **I, A & M**	**YOKE** **AT-SEA** **I, A & M**
NON-STANDARD SCENARIOS			
Scenario #	**4**	**5**	**6**
Readiness **Location** **Configuration**	**X-RAY** **IN-PORT** **I & A**	**YOKE** **IN-PORT** **I & A**	**YOKE** **AT-SEA** **I & A**
Scenario #	**7**	**8**	**9**
Readiness **Location** **Configuration**	**X-RAY** **IN-PORT** **I & M**	**YOKE** **IN-PORT** **I & M**	**YOKE** **AT-SEA** **I & M**
Scenario #	**10**	**11**	**12**
Readiness **Location** **Configuration**	**X-RAY** **IN-PORT** **I**	**YOKE** **IN-PORT** **I**	**YOKE** **AT-SEA** **I**

Certain conditions on some ships result in virtually no difference in the two in port standard scenarios. In these cases, the three standard scenarios may be reduced to two scenarios.

Table 2.4 also describes nine non-standard scenarios (scenarios 4 through 12) which describe "other than normal" conditions. For example, evaluating the ship's response to a fire while underway without considering the contributions provided by automated (A) or manual (M) firefighting may be useful. To accomplish this, the following represents one of the nine non-standard scenarios (scenario number 12 in Table 2.4):

- Material Condition YOKE, at sea, only passive fire protection in effect (I only). This scenario describes the ship at sea, under normal steaming conditions, but does not include the contributions provided by any automated/fixed fire protection systems or the manual firefighting efforts of the crew.

2.4.6. ANALYZE BASELINE RESULTS

The results of running the probabilistic model with the standard scenarios on the baseline data set are carefully examined to determine how well the ship performs as a fire safety system in response to a fire. This is accomplished by examining "RLFS" for "target" compartments. RLFS greater than 1.0 indicate the target compartment failed to meet the FSOS established for that compartment and an improvement in fire protection is needed. A target compartment with a RLF equal to 1.0 indicates the compartment meets

its FSOS. A target with a RLF less than 1.0 indicates the compartment exceeds its FSOS and a reduction in fire protection may be allowable. There are at least three possible reasons that a compartment fails to meet FSOS (more than one can apply):

- The target compartment itself lacks adequate fire protection.
- Another compartment is responsible for fires that spread and ultimately involve the target compartment.
- FSOS for the target compartment were not set properly.

Determining the cause for each failed compartment may involve running the probabilistic model with different output options. For example, the path output option may yield information that many of the fire paths that ultimately involve the target compartment actually originate in another compartment. Thus improving the fire protection in the room of origin may not only improve the results in the target compartment but improve the fire safety in the room of origin as well!

2.4.7. ANALYZE FIRE PROTECTION ALTERNATIVES

To determine ways to improve the fire safety of compartments which fail to meet FSOS, or less typically, to determine ways to reduce fire safety in over-protected compartments, hypothetical alternatives may be efficiently analyzed in SAFE. The alternatives studied should be consistent with the goals established by the sponsor. For example in the SCFP, the sponsor's goals for the nine cutter classes analyzed to date were: (1) reduce the dependence on manual firefighting without a reduction in fire safety levels for the cutter and, (2) improve fire safety so that all compartments meet FSOS in all three standard scenarios. These goals were achieved by running non-standard scenarios (Manual Firefighting "turned off"), then modifying the baseline data set for alternatives that enhance Passive or Automated Firefighting to determine if the improvement is equivalent to the contribution provided by manual firefighting. This step can be a protracted exercise but should be continued until the goals of the analysis are achieved or until all reasonable alternatives have been analyzed.

2.4.8. CONDUCT COST-BENEFIT ANALYSIS

Multiple alternatives should be identified so that a cost-benefit analysis can be conducted to recommend cost effective alternatives. Alternatively a weight-benefit or volume-benefit analysis may be substituted depending on the sponsor's directions. In either event, the "benefit" is quantified by the improvement in the RLFS. The "cost" should take into account the direct and indirect costs of implementing the change. For example the weight, volume or price are examples of direct costs while inconvenience to the crew, damage to the environment, or impact on other missions are examples of indirect costs.

2.4.9. DOCUMENT RESULTS

The final report should document the results of the baseline analysis and consideration of all alternatives. Reports from SAFE can be generated and included to provide supporting data. Graphic reports from SAFE (including color-graphics) can significantly enhance the report. For example SAFE can generate deck plans which

portray compartments which fail to meet FSOS in red, while compartments colored yellow, green or blue are progressively "safer".

2.5. PREVIOUS FIRE SAFETY ANALYSES USING SFSEM/SAFE

2.5.1. POLAR ICEBREAKER REPLACEMENT (PIR)

The preliminary design of the U.S. Coast Guard PIR was analyzed using the SFSEM/SAFE in 1987. [4] This project was important for several reasons. It was the first formal fire safety analysis of a preliminary design of a Coast Guard Cutter. It was also the first time that U.S. Coast Guard naval engineers/management delineated FSOS in detail. Finally it was the first major application of this methodology. The results are considered highly satisfactory; Coast Guard management realized their assessment of FSOS was too lenient but that the exercise has merit. The analysis pointed out several deficiencies in the fire safety design such as identification of redundant fire protection systems and where additional barriers should be installed. The project also served to identify areas where the SFSEM needed further development. Version 1.0 of SAFE was used for the PIR, Versions 2.0 and 2.1 were used in the SCFP, and Version 2.1A was used for the WLM(R). The SAFE User Manual provides the details of improvements incorporated in SAFE. [21]

2.5.2. CGC VIGOROUS (WMEC 627)

A fire safety analysis of the Coast Guard Cutter VIGOROUS was conducted as a term project in a graduate level course in fire protection engineering at the Worcester Polytechnic Institute in 1990. [25] The methodology inherent in the SFSEM was utilized to analyze compartments below the main deck. The focus of this evaluation was on machinery, storage, and habitability areas. The analysis served two important purposes, first it pointed out the need for a computer program to automate the calculations so that a thorough analysis could be conducted in a reasonable time. Secondly the methodology was shown to be appropriate to identify deficiencies in the fire safety design of the vessel. In the case of the VIGOROUS it was clearly evident that the major deficiency was lack of an automatic fire detection system. The analysis also identified weaknesses in the fire protection systems for five specific compartments below the main deck. The SFSEM facilitated an evaluation of alternative fire safety designs to alleviate these problems. The project team also conducted a limited analysis of an actual fire on VIGOROUS that occurred in 1989. While this effort yielded some interesting results, in general, the SFSEM should not be used to conduct a forensic-type post-mortem analysis of a real fire.

2.5.3. SMALL CUTTER FIRE PROTECTION PROJECT (SCFP)

The SCFP Project is a comprehensive effort to analyze the fire safety of small U.S. Coast Guard Cutters between 65' and 180' in length. The final report in the project documents and summarizes the major results, conclusions and recommendations provided in the four interim reports submitted during the course of the project. [3, 12, 13, 14, 15] In addition, the final report includes a detailed fire protection doctrine tailored for nine classes of Patrol Boats, Tugboats, and Buoy Tenders. Each cutter class doctrine provides information pertinent to fire science in part A, firefighting policy and guidance provided by

the Commandant, U.S. Coast Guard for small cutters in part B, and procedures for combating all classes of fires in all conceivable compartments in part C.

The SAFE programs, versions 2.0, 2.1 and 2.1A, were utilized as the analytical tool to conduct a comprehensive analysis of the baseline fire safety and hypothetical improvements to achieve pre-established FSOS. Results indicate that the majority of compartments in small cutters meet FSOS with their existing passive and active fire protection features in effect. The methodology was shown to be a valuable tool to evaluate heretofore incomparable entities such as a better barrier or a more effective firefighting system and quantify their effectiveness. This study clearly demonstrates that it is feasible to reduce reliance on manual firefighting in small cutters by enhancing selective passive and active fire protection features. This study also identified several areas where the SFSEM could be enhanced to improve its effectiveness. Recommendations are also made to improve the fire safety of the cutters studied.

3. FIRE SAFETY ANALYSIS OF THE WLM(R)

An objective in this project is to evaluate the fire safety of the WLM(R) in the preliminary design phase of construction. The basic technical approach includes a thorough analysis of the cutter's existing fire protection levels and potential improvements where the cutter fails to achieve pre-established FSOS. A cost-benefit analysis is required as a basis for cost effective recommendations to achieve these FSOS. A fire protection doctrine is also required that encompasses firefighting procedures for all classes of fires in all types of compartments, in port and at sea.

The technical approach in this project specifies the use of the SFSEM to methodically analyze the cutter as a fire safety system. The SFSEM, under development at the Coast Guard Research and Development Center, will eventually be capable of analyzing all aspects of fire safety including Prevent EB, Flame Movement, Smoke Movement, and People Movement. In addition, the capability for structural analysis may be incorporated. Presently, only the Prevent EB and Flame Movement modules are fully developed and integrated in the SFSEM. Flame movement is analyzed by "starting" a fire in each compartment and predicting the spread of the fire to other compartments based on the probability of failure of existing barriers between compartments and the probability of flame limitation in each compartment on every possible fire path. Results are accumulated and compared to FSOS which establish a permissible MAL and FAL for each compartment.

The SFSEM is particularly useful in examining a wide range of hypothetical improvements to fire safety including a better material for a fire barrier, a better firefighting technique, or better firefighting equipment. The tool is robust in that these usually incomparable entities can be readily compared to examine their relative ability to achieve FSOS.

The following sections of this report will address various aspects of the process used to analyze cutter fire safety which ultimately resulted in the development of the fire protection doctrine described in section 4.0 and documented in Appendix E of this report. These aspects include:

- Historical Fire Data Analysis. The SFSEM relies on historical data for the calculation of the "frequency of EB," which in turn is used to calculate the probability of flame limitation.
- Preliminary Fire Safety Analysis. A preliminary analysis is conducted and documentation is collected in conjunction with a visit to the shipyard. Information required to run the computer programs associated with the SFSEM is also collected and verified during this stage.
- Detailed Fire Safety Analysis using SFSEM/SAFE. The SFSEM and its implementing computer programs, SAFE, are used to perform a detailed fire safety analysis of existing "baseline" fire protection levels and to compare hypothetical improvements to fire safety in compartments which fail to meet FSOS.

3.1. HISTORICAL FIRE DATA ANALYSIS

The following events are necessary for fire to spread beyond the room of origin:

- Ignition occurs
- EB occurs
- Flames do not self-extinguish
- Flames are not suppressed by fixed fire extinguishing system
- Flames are not suppressed manually
- FRI occurs
- Barriers fail to contain the fire within the space

Each of these events is dependent on the occurrence of previous event(s) in the list. In the life cycle of a fire, Established Burning is a concept which describes the size of the fire that denotes the end of the fire prevention phase and the beginning of the ship's response to a fire. The probability that EB will occur is therefore equivalent to the probability that fire prevention failed. The probability of EB can be calculated by multiplying the probability of ignition times the probability that the fire will grow to the critical size defined as EB. Calculating this probability is primarily useful in a study of the fire prevention phase, however it is also used in the calculation of the probability of limiting flame spread.

The probability of EB and the frequency of EB are two alternative ways of expressing the likelihood of the EB event occurring in a given compartment. Military ships, including Coast Guard Cutters, are required to report all fires that result in damage or personnel injury. This provides the opportunity to utilize historical records to determine the frequency of EB. Historical data does not involve the subjective judgment required in determining probabilities. Therefore the alternative "frequency of EB" is utilized in the SFSEM. The next section describes how this frequency was calculated for the cutters studied in the SCFP to date as well as the WLM(R).

3.1.1. FREQUENCY OF ESTABLISHED BURNING

Historical reports of fires on all classes of Coast Guard Cutters was obtained from the Commandant (G-KSE-4), U.S. Coast Guard, for the period 1986 through 1991. This data was combined with data received from the U.S. Naval Safety Center on 21 classes of large naval vessels during the period 1975 through 1986 to refine the reported fire frequencies. For the purposes of the SFSEM, similar compartments were grouped by "compartment use indicator (CUI)". CUI categories were adapted from the standard nomenclature used by the Coast Guard and Navy to identify compartment usage. Some CUIS were further subdivided in order to reflect a more accurate assignment of reported fire frequency. Experience has shown that some fires which reach EB, do little or no damage to the vessel and result in no injuries to personnel, thus they are unreported. As a result, the "reported frequency of EB" based on historical data was doubled and called "adjusted fire frequency" to account for unreported fires. The number of fires reported and adjusted fire frequency values from the combined Navy and Coast Guard data is shown in Table 3.1 grouped according to CUI. The Main Propulsion Mechanical and

Table 3.1 Fire Frequency Data

Type of Compartment	Compartment Use Indicator (CUI)	Number of Fires Reported	Adjusted Fire Frequency (1) (Fires per Compt Year)
Cargo Hold	AA	0 (2)	0.0001 (3)
Gear Locker	AG	19	0.0010
Refrigerated Storage	AR	3	0.0009
Storeroom	AS	34	0.0009
Ship Control Area	C	4	0.0012
Main Propulsion Electrical (4)	EE	7	0.0031
Main Propulsion Mechanical	EM	148	0.0272
Fuel Oil, Lube Oil Tank	F	0 (2)	0.0001 (3)
JP-5 Fuel Tank	J	0 (2)	0.0001 (3)
Hazardous Material Storage	K	4	0.0013
Berthing Space	L1, L2, L5	20	0.0008
Wardroom, Mess, Lounge Space	LL	7	0.0008
Medical, Dental Space (4)	LM	0	0.0001
Passageway, Staircase, Vestibule	LP	3	0.0001
Sanitary Space	LW	4	0.0002
Explosives Storage	M	1	0.0001
Auxiliary Machine Space (4)	QA	89	0.0029
Emergency Aux Generator Room (4)	QE	23	0.0204
Fan Room	QF	7	0.0004
Galley Pantry, Scullery	QG	13	0.0026
Helicopter Hangar	QH	3	0.0036
Laundry	QL	5	0.0031
Office Space (4)	QO	5	0.0004
Shops, Labs	QS	15	0.0018
Trunk, Hoist, Dumbwaiter	TH	0 (2)	0.0001
Stack, Uptake	TU	5	0.0013
Void, Cofferdam	V	1	0.0001 (3)
Water, Peak, Ballast Tank	W	1 (2)	0.0004

NOTES:

(1) Taken as twice the reported fire frequency

(2) Based on 1986 - 1991 USCG data only. (All other numbers of fires based on both USN and USCG data.)

(3) Default value used in cases where no fires have been reported, or when calculated adjusted frequency is below 0.0005

(4) New compartment types added since analysis of three small cutters

Emergency Auxiliary Generator Room exhibit adjusted fire frequencies which are orders of magnitude greater than other compartments.

The data provided by the Commandant (G-KSE-4) was also analyzed to obtain information such as: the frequency that arson is a problem, the frequency of fires that spread to other compartments from the room of origin, the class of fires that most frequently occur, the type of compartment where high dollar loss fires occur, etc. The next section describes the results of this analysis.

3.1.2. HISTORICAL RECORDS

Coast Guard data included reports of 29 fires and explosions over a five year period (FY 86 through FY 91) on cutters that represent 95% of the Coast Guard operational fleet of cutters greater than 65' in length. Three of the 29 fires (10%) occurred in 378' High Endurance Cutters; 13 fires (45%) occurred in 270' and 210' Medium Endurance Cutters, 180' Seagoing Buoy Tenders, and 140' Icebreaking Tugboats; the remaining 15 (45%) occurred in cutters ranging from 65' Harbor Tugboats to 110' Island Class Patrol Boats, and Construction Buoy Tenders. No fires were reported by the 11 cutters in the two classes of Coastal Buoy Tenders during this period.

Most reported fires for WLM's are relatively minor. Only 7 fires resulted in damage estimated to exceed $1000. There were no deaths, 6 minor injuries, and 25 fires with no injuries. Arson was not considered a factor in any fire. Additional mishap report data provided by Commandant (G-KSE-4) shows that the majority of high dollar loss fires originate in the Engine Room.

An analysis of the data showed 18 class A, 4 class B, 5 class C fires and 4 explosions. Forty-two percent of the fires occurred in port, 29% underway, 23% during a Yard period, and 6% unknown. Note the period of time a vessel was undergoing FRAM, SLEP or MMA was excluded. COMDTINST M9000.6B, Table 081-1 lists the required maintenance days for each class of cutter. [9] The remaining days are available for operations, and the cutter can be assumed to be underway. Small cutters are shown to be underway 64% to 79% of the time. Therefore the percentage of fires that occur underway is much less than the percentage of time the cutter could be underway. On the other hand, a disproportionately high percentage of fires occur in port.

Most fires were quickly extinguished by the crew; 90% (24 fires and 4 explosions) were extinguished within 5 minutes. Only three fires took longer than 5 minutes to extinguish. This probably accounts for the related fact that 94% of all fires were contained to the room of origin, only two fires spread to involve multiple compartments.

Since no fires were reported by the 11 Coastal Buoy Tenders from 1986 through 1991, further research was conducted to evaluate the historical fire safety of the 157' and 133' WLM classes of U.S. Coast Guard Coastal Buoy Tenders. Data collected during the period FY 84 through FY 92 shows three reported fires by the 6 cutters in the 133' WLM class and two reported fires by the 5 cutters in the 157' WLM class. [26] This equates to a frequency of reported fire for all Coastal Buoy Tenders of 5 fires in 99 cutter-years. **Therefore, based on 9 years of historical data, a U.S. Coast Guard Coastal Buoy Tender can expect a reportable fire once every 19.8 years.** The extraordinary fire safety record of this type of cutter may be partially attributed to the fact that these cutters are operated at relatively slow speeds for relatively short periods of time compared to

other Coast Guard Cutters. Thus the main engines, which account for many of the serious fires on other cutters in the Coast Guard, are not operated at high speeds for long periods which tend to generate very high temperatures especially in way of the turbochargers.

3.2. PRELIMINARY FIRE SAFETY ANALYSIS

Information required to conduct a preliminary fire safety analysis is collected during the ship visit. The ship visit has the following specific purposes as explained in the Theoretical Basis of the SFSEM [2]:

- Conduct fire safety audit
- Collect detailed information to accomplish the fire safety analysis using the SFSEM/SAFE
- Collect and review all relevant documentation concerning firefighting procedures
- Observe fire drill

The fire safety audit is conducted to identify existing passive and active fire protection features and procedures, determine fuel loads and any unusual fire hazards, and to evaluate the accessibility of compartments for firefighting and egress routes for personnel. When possible, a fire drill is observed to assess the characteristic time it takes to set ZEBRA and to enable the analyst to assess manual firefighting effectiveness. The cutter's Main Space Fire Protection Doctrine, Casualty Control Manual, Compartment Check-off Lists, and Repair Locker Inventory and other critical information regarding the cutter's firefighting procedures is collected and reviewed. In the case of the WLM(R), the cutter does not yet exist, therefore the documentation described above does not exist, nor is it possible to observe a fire drill. The COR, drawings, and specifications for the WLM(R) provide certain details concerning compartmentation, proposed fire protection systems and equipment, etc. Marinette Marine Shipyard was also visited to collect additional details concerning the proposed fire protection systems. It was noted during this visit that Marinette Shipyard and the Coast Guard Resident Inspector's staff consider fire safety a high priority in the detailed design and construction of the WLM(R). The following sections describe the results of the detailed review of the COR, drawings, and specifications as well as the shipyard visit. The results of this review are organized according to the phases in the life cycle of a fire commencing with prevention, and proceeding through detection, containment, and extinguishment.

3.2.1. PREVENTION

The fire prevention phase also includes first aid or the initial attempts to extinguish a fire after ignition occurs but before the fire grows substantially beyond the point described as EB. A major factor in the fire safety design of the WLM(R) is the fact that the COR invokes appropriate sections of the International Convention for Safety of Life at Sea (SOLAS), American Bureau of Shipping (ABS), and the Code of Federal Regulations (CFR). This ensures the shipbuilder complies with comprehensive requirements for fire safety in all aspects of the design and construction of the ship, however, it does not guarantee a fire safe vessel! Moreover, the Resident Inspector's staff and the ABS inspector are obviously knowledgeable and conscientious about interpreting the various regulations in a conservative manner that ensures the highest possible degree of fire safety

for this ship. A review of all available documentation such as the COR, drawings, etc., and a visit to the shipyard did not reveal the existence of any unusual ignition hazards or unnecessarily high fuel loads. In addition, the shipyard plans to install in accordance with the requirements of the COR, adequate quantities and types of firefighting equipment in appropriate locations throughout the vessel to combat the anticipated fire threat as shown in Table B.5.1 in Appendix B. The anticipated fire threat is determined from the quantity and type of combustible fuel loads shown in Table B.7.2 in Appendix B. Furthermore the firefighting agents that will be deployed are considered appropriate for the anticipated class of fire.

The compartmentation drawings were reviewed in detail to determine if adequate means of egress, in accordance with the requirements of SOLAS, exist for crew members to escape, and to assess the ability of the crew to access each compartment for the purposes of firefighting. [27] The proposed compartmentation appears to meet or exceed the minimum requirements for egress with the exception of enlisted stateroom 1-79-2-L. The installation of a kick-out panel in the associated sanitary space for this stateroom, 1-83-2-L, would provide a second egress route via stateroom 1-79-1-L; this stateroom has an emergency escape scuttle to the 01 weather deck. This appears to be an easier and less expensive solution compared to installing an emergency escape scuttle in the overhead of 1-79-2-L. Both of these staterooms are designed for four persons. It also appears that there is adequate access for firefighting purposes to all compartments where a potential fire could occur.

3.2.2. DETECTION

There are two ways a fire can be detected on board ship - by a crew member or by an installed mechanical device. As the proposed crewing levels decrease with the minimal manning concept, it becomes more important to install a sophisticated fire detection system to ensure early detection of fire while the fire is small and more amenable to extinguishment. Moreover, fire typically grows exponentially with time, and it is significantly easier to extinguish a small fire than a large fire. The 175' WLM(R) will have a crew of 17 persons compared with the existing 180' WLB Buoy Tender, for example, which has a crew of 35 or the 157' WLM Buoy Tender which has a crew of 33.

Section 436-2 of the COR requires a fire detection system to protect virtually every compartment in the ship. Therefore, all compartments are monitored continuously. While the type of detector to be installed in each compartment is unknown at this stage of construction, it is presumed that appropriate types of detectors will be installed, for example:

- Ionization type smoke detector in most compartments, especially berthing areas and staterooms.
- Photoelectric type smoke detectors and infra-red flame detectors in the Engine Room and Emergency Generator Room.
- Voids, chain lockers and water/fuel/lube/ballast tanks are not monitored

3.2.3. CONTAINMENT

If a fire grows beyond EB, it is desirable to contain the fire within the room of origin to minimize the damage. All bulkheads and decks which serve as barriers to contain the fire were examined to determine their adequacy for this purpose. In addition, the watertight doors and other accesses are assumed to be classified for damage control purposes in accordance with the requirements of Chapter 079, NSTM. Barrier materials modeled in the SFSEM/SAFE were selected from the catalog of barriers based on the assumption that the actual barriers will be in compliance with the various regulations invoked by the COR. Moreover section J, attachment 1 of the COR, requires certain boundaries to be insulated to reduce condensation and to ensure the efficiency of the HVAC system. Insulation, also serves to reduce heat from spreading to adjacent spaces thus slowing the spread of fire. **The fire safety analysis discussed in this report is thus predicated on strict compliance with the COR and all invoked second tier references.**

3.2.4. EXTINGUISHMENT

The WLM(R) is designed to have two fire pumps installed in two different fire zones to ensure the continued availability of a fire pump. The current design proposes to utilize a common sea suction, therefore if the vessel is grounded, becomes entangled in a kelp bed, or otherwise fouls this single source of supply, both fire pumps would be lost. The intent of the regulation is to ensure maximum independence of these two sources of firemain pressure.

The COR requires redundant automated fire protection systems in the Engine Room in the form of a total flooding CO_2 and AFFF bilge sprinkling system. This redundancy is considered especially appropriate due to the extremely low manning levels in this vessel and due to the fact that the Engine Room is normally unmanned and represents a significant class B and class C fire threat. An automated AFFF sprinkler system is presently planned for the Bow Thruster Propulsion Room. In view of the fact that the primary fire threat is a class C fire in the bow propulsion electrical motor/controller, consideration should be given to installing a CO_2 total flooding system instead of AFFF.

Ability to manually fight fires is adequately provided in terms of firemain systems, AFFF re-entry fire stations, and numerous portable fire extinguishers located throughout the vessel. It is also presumed that the ship will be outfitted with adequate apparel and equipment for personnel protection such as firefighters ensembles, OBAS, etc. in accordance with the Cutter Standard Repair Locker Inventory, COMDTINST M9664.1. [28]

3.3. DETAILED FIRE SAFETY ANALYSIS USING SFSEM/SAFE

The SFSEM/SAFE requires an extensive amount of data to facilitate an analysis of the cutter's fire safety. Preprinted ship visit forms, prepared in advance, ensure information concerning fuel loads, compartmentation, ventilation and other required data is collected in an efficient manner. This information is also used by the engineer/analyst to

temper the engineering judgment required to develop the probabilistic values entered into SAFE. The ship visit forms for the WLM(R) were completed by the engineer/analysts based on the available information in the COR, drawings provided by Marinette Marine Shipyard, and supplemented by engineering judgment where details were lacking. The baseline data collected and developed for the WLM(R) are documented in Appendices B and C including the sources of information and assumptions made when information was unknown.

The probabilities of flame termination and barrier failure in each compartment are the key values the analyst determines based on engineering judgment. There are three ways a fire can occur in a compartment:

1. It can originate in the compartment (EB),
2. It can enter via a hot spot or thermal barrier failure (Tbar)
3. It can enter via a massive or durability barrier failure (Dbar).

There are also three ways a fire can terminate in a compartment:

1. Self extinguishment (I),
2. Suppression by automated/fixed fire extinguishing systems (A),
3. Manual suppression (M).

Therefore, a 3 x 3 matrix of 9 probabilities of flame termination are required to completely characterize the probability of flame limitation in each compartment. Table 3.2 lists the probabilities that were assigned to the Engine Room in the WLM(R). This table shows that it is more likely that a fire will extinguish itself (I) if the fire enters the compartment as a result of a hot spot failure in a bulkhead (Tbar) than if it enters the compartment as a result of a massive failure of the bulkhead (Dbar). Moreover, it is even less likely to extinguish itself if the fire originates in the compartment (EB). Similarly, it is more probable that a fire party will extinguish a fire (M) if it enters the compartment from an adjacent compartment due to a failure of the bulkhead (Tbar or Dbar) than if it originates in the compartment (EB). The reason for this is primarily because the fire party has more time to respond, but the severity of the fire is also likely to be less. These probabilities were assigned for the WLM(R) based on engineering judgment of the engineer/analyst tempered by the values assigned to similar compartments on other small Coast Guard Cutters.

Table 3.2 Probabilities of Flame Termination in a Compartment

	EB	Tbar	Dbar
I	40	48	44
A	90	99	99
M	20	24	22

Barriers themselves are assigned a curve for both the probability of thermal failure and the probability of durability failure based on the type of barrier material. These curves plot the probability of failure versus heat energy impact for each barrier material for each failure mode (Tbar and Dbar). Certain barrier materials, such as the decorative joiner work to be installed as non-structural interior partitions, were unknown at this stage of the

preliminary design. In these cases, engineering judgment was used to select an appropriate barrier material from the existing catalog of curves in the SFSEM database.

Fuel loads represent the combustible contents of a compartment. Fuel loads were determined by examining the COR, specifications and drawings provided by the shipyard which provided information concerning the outfit or proposed furnishings in each compartment. In addition, typical fuel loads for similar compartments were determined from a visit to the Coast Guard Cutter REDWOOD (WLM 685). Finally, two reports from the literature were studied to glean information concerning typical fuel loads and weights of combustibles on other naval ships which "map" over to the WLM(R). [29, 30] Fuel loads for each compartment are tabulated and documented in Appendix B-7.

FSOS are established for each compartment because the SFSEM is a performance based methodology and FSOS establish acceptable performance. The "baseline" refers to the fire safety levels of the ship as it exists before any proposed modifications. A baseline analysis is performed to compare the ship's performance against the FSOS. A powerful feature of the SFSEM is its capability to analyze alternatives to improve fire safety of compartments which fail to achieve minimal standards of performance. Lastly, a cost benefit analysis is conducted to assist the analyst in determining which of the acceptable alternatives is the most cost-effective. The following sections describe each of these major areas relevant to the WLM(R).

3.3.1. FIRE SAFETY OBJECTIVES (FSOS)

As noted above, FSOS establish the minimal acceptable performance standards for each compartment in the vessel being analyzed. Ideally, FSOS are established by "cognizant authorities" in terms of MAL and FAL taking into account the following considerations:

- Life Safety. This includes all persons on board such as the crew on-watch and off-watch, as well as passengers
- Property Protection. This includes the ships outfit and furnishings as well as cargo
- Mission Protection. The ship may have multiple missions that may be prioritized into primary and secondary missions.

Cognizant authorities for the WLM(R) include various offices of the Commandant, U. S. Coast Guard. In the absence of such input, the FSOS for the WLM(R) Replacement Coastal Buoy Tender were established by the engineer/analysts conducting the fire safety analysis following the approach described in section 2.2.1 of this report and documented in Appendix B.3. The FSOS established for the WLM(R) are consistent with those established for the nine classes of small Coast Guard Cutters. **Approval of this report by Coast Guard cognizant authorities, implies approval of the FSOS established for this class of cutter**.

The process for assigning FSOS is a complex and contentious issue. It includes identification of cognizant authorities, and then ensuring they are trained and knowledgeable to assign FSOS. In addition, it involves integrating multiple considerations for flame movement; in the future the SFSEM will include the ability to analyze smoke

movement which will further complicate the process. Moreover, as described in section 2.2.1, there has been some discussion that assigning FSOS on a compartment basis may not be appropriate; assigning FSOS at the ship or even ship class level may be more appropriate. Finally FSOS presently do not take into account the effect that losing one compartment has on another. For example ships with redundant engine rooms would require the loss of both engine rooms simultaneously before the ship's mission would have to be aborted. Consequently, the subject and methodology of establishing FSOS is under intense study.

3.3.2. BASELINE ANALYSIS

The first step in the detailed fire safety analysis of a ship with the SFSEM is a determination of the existing fire protection levels. To facilitate discussion, this result is referred to as the "baseline". Data sets identified as "Baseline" utilize input values to the SAFE program based on the physical condition of the ship found during the ship visit and are not influenced by any modifications or alterations which may be proposed as a result of this analysis. A standard scenario is specified when SAFE is run that includes user-defined parameters such as barrier failure criteria, simulation run time, ship location, material condition of readiness etc. Standard scenarios are established to describe operating conditions for the cutter over the majority of its life cycle.

The complete baseline results for the WLM(R) are documented in Appendix D, Table D.1, for the three standard and nine non-standard scenarios. The baseline results for the ship in material condition XRAY show a higher FAL/MAL compared to the scenarios where the ship is in material condition YOKE. This result is expected since more doors and hatches are open in Condition XRAY which permits better ventilation of the growing fire and enhances the ability of the fire to spread to adjacent compartments. **These results show that all compartments in the WLM(R) with passive (I), automated (A), and manual (M) fire protection features in effect exceed FSOS by a substantial margin.** This means that no improvements are required to bring the WLM(R) up to acceptable fire safety levels. Moreover, the baseline results show that even without considering manual firefighting efforts, all compartments in the WLM(R) exceed FSOS. In other words, **the WLM(R) built in accordance with the preliminary design considered in this analysis, exceeds minimal FSOS for all compartments with just passive and automated/fixed fire protection in effect.**

The baseline analysis is designed to identify compartments which fail to meet FSOS so that attention can be focused on these compartments. Ideally, multiple hypothetical alternatives are identified and studied that improve the fire safety to minimally acceptable levels; a cost-benefit analysis, can then be conducted to form the basis for recommendations. Since the WLM(R) already exceeds FSOS in all compartments, it was decided that a number of alternatives would be studied that may identify reasons for the relatively high fire safety levels of this ship. A subset of the baseline analysis results for the "in port, material condition XRAY" scenario, are shown in tables D.2 through D.5 in Appendix D for the four different levels of fire protection (I, I & A, I & M, and I, A, & M). The following sections describes the nine alternatives that were studied to further evaluate the fire safety of the WLM(R).

3.3.3. ANALYSIS OF ALTERNATIVES

An alternative data set modifies the parameters of the baseline data set such that it represents the conditions that would be in effect if that alternative were installed on the cutter. The outputs from SAFE running the target option include RLFS (RLF) for each compartment. RLFS represent a relative comparison to the FSOS. Baseline or alternative data sets may be analyzed in combination with standard or non-standard scenarios to consider various alternatives. Once the situation is defined by the analyst, values are assigned that numerically represent the appropriate probabilities involved. These inputs and the rest of the parameters unaffected by this alternative are loaded into SAFE which then calculates RLFS for this alternative. RLFS greater than 1.0 indicates a compartment has failed to meet the FSOS and an improvement to fire safety is needed. RLFS equal to 1.0 indicate a compartment meets FSOS. RLFS less than 1.0 indicate a compartment exceeds FSOS and a reduction in fire protection may be warranted. Alternatives may also be rank-ordered by RLF for their effect on fire safety (i.e. lower RLFS equate to greater fire safety). The following sections discuss results of the nine alternatives analyzed in this project. Each of the nine alternatives is described in detail with a table of results shown on the facing pages. To focus attention on the results described, certain cells in the tables are highlighted that correspond to the explanation of results in the associated text.

3.3.3.1. Alternative #1: Reduce Percent Monitored

The WLM(R), unlike most other Coast Guard Cutters, is designed to have an automatic fire detection system installed to protect all compartments. From a fire safety point of view, this means that all compartments are "monitored" continuously to detect the presence of flame, smoke, or heat. Ideally, if a compartment is monitored 100% of the time, there is no additional delay in setting Condition Zebra. Accordingly, Percent Monitored values were set in the baseline data set to 95% to reflect the fact that automatic fire detectors are installed throughout the ship. These values are not set to 100% to reflect the reliability of the mechanical equipment. It was hypothesized that such an automatic fire detection system would result in the setting of ZEBRA early in the fire which would result in slowing the spread of the fire. To evaluate the effect of a much improved fire detection system compared to other Coast Guard Cutters it was decided to modify "percent monitored" values both at sea and in port to reflect the reduced values assigned on the nine cutter classes previously analyzed as shown in Table 3.3.

Table 3.3 Percent Monitored Values for Previously Studied Cutters

CUI	AT SEA	IN PORT		CUI	AT SEA	IN PORT		CUI	AT SEA	IN PORT
AA	10	10		**L5**	95	95		**QG**	60	80
AS	0	0		**LL**	95	95		**QL**	80	40
C	80	30		**LP**	20	40		**QO**	50	60
EM	95	95		**LW**	10	20		**QS**	30	70
K	95	95		**QA**	10	30		**TU**	15	15
L1	95	95		**QE**	95	95		**V**	0	0
L2	95	95		**QF**	10	30		**W**	0	0

As shown in Table 3.4, results of running the probabilistic model on this alternative data set with all passive, automated and manual fire protection features in effect show a slight, but distinct, decrease in fire safety levels in most compartments, however all compartments continue to meet FSOS. Considering only passive and automated fire protection, all compartments meet FSOS with the exception of the Chart Room (in the baseline, the Chart Room was acceptable). Seven compartments fail to meet FSOS with just passive fire protection in effect, compared to six failures in the baseline. **Therefore, reducing the fire detection system planned for this ship to that normally installed in other small cutters would not, by itself, result in unacceptable fire safety for this cutter.**

Table 3.4 Relative loss Factors (RLF) Baseline and Alternative #1 Data Sets

			I/A/M		I/A		I/M		I Only	
			Scenario 1		Scenario 4		Scenario 7		Scenario 10	
Plan ID	Compartment Name	CUI	Baseline	Alt 1	Baseline	Alt 1	Baseline	Alt 1	Baseline	Alt 1
	Run No.		6-2	6M-26	6-5	6M-27	6-8	6M-28	6-11	6M-29
1-6-3-Q	Paint Locker	K	0.41	0.45	0.84	0.91	0.52	0.56	1.09	1.16
02-61-0-C	Chart Room	QO	0.38	0.42	0.97	1.22	0.89	0.97	3.08	3.57
02-70-0-Q	Stack	TU	0.21	0.22	0.46	0.54	0.60	0.62	1.65	1.87
1-70-1-Q	Uptake	TU	0.16	0.17	0.29	0.32	0.43	0.44	0.73	0.77
02-68-2-E	Emergency Generator Room	QE	0.16	0.17	0.31	0.38	0.49	0.54	1.26	1.62
02-52-0-C	Pilothouse	C	0.15	0.26	0.38	0.70	0.23	0.35	0.68	1.11
1-61-0-L	Mess Room	LL	0.15	0.18	0.35	0.48	0.61	0.70	1.56	1.97
1-76-2-Q	Scullery	QG	0.10	0.11	0.19	0.23	0.55	0.61	1.14	1.40
3-6-0-E	Bow Thruster Room	EM	0.09	0.09	0.15	0.15	0.12	0.12	0.20	0.21
1-61-2-Q	Galley	QG	0.06	0.08	0.10	0.16	0.25	0.28	0.42	0.55
3-88-0-E	Propulsion Thruster Room	QA	0.05	0.06	0.11	0.13	0.14	0.16	0.36	0.45
1-6-2-Q	ATON Shop	QS	0.05	0.07	0.10	0.13	0.07	0.09	0.13	0.16
02-68-1-Q	Battery Locker	AG	0.04	0.07	0.05	0.12	0.04	0.08	0.05	0.14
3-52-0-C	Engineering Control Center	C	0.04	0.04	0.07	0.08	0.20	0.22	0.35	0.41
3-61-0-E	Main Engine Room	EM	0.04	0.04	0.05	0.05	0.49	0.49	0.76	0.78
3-15-0-E	Hydraulic Equipment Room	QA	0.03	0.03	0.06	0.06	0.03	0.03	0.08	0.08
01-50-0-C	Buoy Deck Control Room	C	0.03	0.04	0.09	0.12	0.06	0.08	0.34	0.47
3-57-1-Q	Elec Shop	QS	0.02	0.02	0.05	0.05	0.12	0.12	0.29	0.29
3-79-0-Q	Pump Room	QA	0.02	0.02	0.04	0.04	0.11	0.12	0.21	0.24
02-61-1-Q	PFD Locker	AG	0.02	0.07	0.02	0.13	0.02	0.08	0.02	0.15
02-61-2-Q	PFD Locker	AG	0.02	0.07	0.02	0.12	0.02	0.08	0.02	0.18
1-0-0-Q	Boatswain Locker	AG	0.01	0.02	0.02	0.03	0.01	0.02	0.02	0.03
01-70-1-Q	Boat Locker	AG	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.02
1-6-1-Q	Service Locker	QS	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.02
1-79-1-L	Enlisted SR (4)	L5	0.00	0.02	0.00	0.03	0.00	0.02	0.00	0.05
2-24-0-AA	Cargo Hold	AA	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01

3.3.3.2. Alternative #2: Remove All Insulation

The WLM(R) is very well insulated to ensure the efficiency of the HVAC system. It is reasonable to expect that this insulation would also help contain the heat from a fire within the room of origin thus slowing the spread of fire to adjacent spaces. On the other hand, insulated barriers prevent the loss of heat from the burning fuel, thus increasing the fire severity in the room of origin. Therefore insulation has a beneficial effect for adjacent spaces and an adverse effect on the room of origin and it is unclear what the effect would be on the overall fire safety of the cutter. Accordingly, all insulated barriers were changed to non-insulated barriers of the same substrate material to demonstrate the effect of insulation on the relative FAL compared to the baseline. It should be noted that the probabilities of extinguishing the fire given a Tbar or Dbar failure were unchanged from the baseline in each compartment. In addition, even though insulation represents a combustible fuel load, the fuel load values in each compartment were not changed for this alternative. Only the barrier material was "changed," which reflects a generally higher probability of Tbar and Dbar failures for the same heat energy impact.

Table 3.5 shows the results of running the probabilistic model on this alternative data set. With passive, automated and manual fire protection features in effect, results predict a slight, but distinct, decrease in fire safety levels in all compartments, even though all compartments continue to meet FSOS. Considering only passive and automated fire protection, all compartments meet FSOS with the exception of the Pilothouse and the Chart Room (in the baseline, these compartments were acceptable). Eight compartments fail to meet FSOS with just passive fire protection in effect, compared to six failures in the baseline. **Therefore insulated barriers in the WLM(R) appear to be more beneficial than harmful, from a fire safety point of view. Comparing the results of alternative #1 to the results of alternative #2 (see Tables D-2 through D-5), it also appears that eliminating insulation would have a greater adverse effect on fire safety than reducing the effectiveness of the fire detection system.**

Table 3.5 Relative loss Factors (RLF) Baseline and Alternative #2 Data Sets

			I/A/M		I/A		I/M		I Only	
			Scenario 1		Scenario 4		Scenario 7		Scenario 10	
Plan ID	Compartment Name	CUI	Baseline	Alt 2	Baseline	Alt 2	Baseline	Alt 2	Baseline	Alt 2
	Run No.		6-2	6M-30	6-5	6M-31	6-8	6M-32	6-11	6M-33
1-6-3-Q	Paint Locker	K	0.41	0.45	0.84	0.90	0.52	0.57	1.09	1.15
02-61-0-C	Chart Room	QO	0.38	0.54	0.97	1.42	0.89	1.25	3.08	4.23
02-70-0-Q	Stack	TU	0.21	0.23	0.46	0.57	0.60	0.58	1.65	1.69
1-70-1-Q	Uptake	TU	0.16	0.23	0.29	0.57	0.43	0.72	0.73	1.85
02-68-2-E	Emergency Generator Room	QE	0.16	0.20	0.31	0.44	0.49	0.61	1.26	1.65
02-52-0-C	Pilothouse	C	0.15	0.40	0.38	1.05	0.23	0.68	0.68	2.04
1-61-0-L	Mess Room	LL	0.15	0.15	0.35	0.34	0.61	0.55	1.56	1.40
1-76-2-Q	Scullery	QG	0.10	0.11	0.19	0.20	0.55	0.57	1.14	1.22
3-6-0-E	Bow Thruster Room	EM	0.09	0.09	0.15	0.15	0.12	0.12	0.20	0.20
1-61-2-Q	Galley	QG	0.06	0.07	0.10	0.12	0.25	0.26	0.42	0.47
3-88-0-E	Propulsion Thruster Room	QA	0.05	0.06	0.11	0.13	0.14	0.18	0.36	0.59
1-6-2-Q	ATON Shop	QS	0.05	0.10	0.10	0.16	0.07	0.12	0.13	0.20
02-68-1-Q	Battery Locker	AG	0.04	0.15	0.05	0.23	0.04	0.23	0.05	0.35
3-52-0-C	Engineering Control Center	C	0.04	0.04	0.07	0.07	0.20	0.23	0.35	0.52
3-61-0-E	Main Engine Room	EM	0.04	0.04	0.05	0.05	0.49	0.50	0.76	0.82
3-15-0-E	Hydraulic Equipment Room	QA	0.03	0.03	0.06	0.06	0.03	0.03	0.08	0.08
01-50-0-C	Buoy Deck Control Room	C	0.03	0.04	0.09	0.15	0.06	0.13	0.34	0.87
3-57-1-Q	Elec Shop	QS	0.02	0.02	0.05	0.05	0.12	0.13	0.29	0.26
3-79-0-Q	Pump Room	QA	0.02	0.02	0.04	0.04	0.11	0.12	0.21	0.22
02-61-1-Q	PFD Locker	AG	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
02-61-2-Q	PFD Locker	AG	0.02	0.10	0.02	0.15	0.02	0.17	0.02	0.24
1-0-0-Q	Boatswain Locker	AG	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.02
01-70-1-Q	Boat Locker	AG	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.02
1-6-1-Q	Service Locker	QS	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1-79-1-L	Enlisted SR (4)	L5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-24-0-AA	Cargo Hold	AA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.3.3.3. Alternative #3: Assume All Windows Lost

If a window or portlight were to break during a fire, the resulting increased ventilation would presumably increase the fire damage. Since the WLM(R) is designed with a number of windows in the Staterooms, Mess Deck, Pilot House, Buoy Deck Control Room and other spaces it was desirable to examine what would happen if all windows in all compartments were to fail. Accordingly, all windows in all compartments were treated as additional ventilation areas in SAFE. Table 3.6 shows results of running the probabilistic model on this alternative data set.

As expected, the results show a very slight decrease in fire safety levels, however all compartments continue to meet FSOS with passive, automated and manual fire protection in effect. The Chart Room and Pilothouse fail to meet FSOS considering only passive and automated fire protection (all compartments were acceptable in the baseline). Considering passive fire protection only, eight compartments fail to meet FSOS compared to six in the baseline. **Therefore, breaking windows in a fire would only slightly increase the fire damage this cutter may otherwise expect. This increase in expected fire damage by itself is not considered unacceptable considering the FSOS.**

Table 3.6 Relative loss Factors (RLF) Baseline and Alternative #3 Data Sets

			I/A/M		I/A		I/M		I Only	
			Scenario 1		Scenario 4		Scenario 7		Scenario 10	
Plan ID	Compartment Name	CUI	Baseline	Alt 3	Baseline	Alt 3	Baseline	Alt 3	Baseline	Alt 3
	Run No.		6-2	6M-34	6-5	6M-35	6-8	6M-36	6-11	6M-37
1-6-3-Q	Paint Locker	K	0.41	0.41	0.84	0.84	0.52	0.52	1.09	1.09
02-61-0-C	Chart Room	QO	0.38	0.40	0.97	1.08	0.89	0.92	3.08	3.18
02-70-0-Q	Stack	TU	0.21	0.24	0.46	0.56	0.60	0.54	1.65	1.33
1-70-1-Q	Uptake	TU	0.16	0.21	0.29	0.55	0.43	0.57	0.73	1.51
02-68-2-E	Emergency Generator Room	QE	0.16	0.18	0.31	0.40	0.49	0.61	1.26	1.73
02-52-0-C	Pilothouse	C	0.15	0.31	0.38	1.09	0.23	0.54	0.68	2.32
1-61-0-L	Mess Room	LL	0.15	0.15	0.35	0.36	0.61	0.61	1.56	1.57
1-76-2-Q	Scullery	QG	0.10	0.10	0.19	0.19	0.55	0.55	1.14	1.14
3-6-0-E	Bow Thruster Room	EM	0.09	0.09	0.15	0.15	0.12	0.12	0.20	0.20
1-61-2-Q	Galley	QG	0.06	0.06	0.10	0.10	0.25	0.25	0.42	0.42
3-88-0-E	Propulsion Thruster Room	QA	0.05	0.05	0.11	0.11	0.14	0.14	0.36	0.36
1-6-2-Q	ATON Shop	QS	0.05	0.05	0.10	0.10	0.07	0.07	0.13	0.13
02-68-1-Q	Battery Locker	AG	0.04	0.04	0.05	0.05	0.04	0.04	0.05	0.05
3-52-0-C	Engineering Control Center	C	0.04	0.04	0.07	0.08	0.20	0.20	0.35	0.37
3-61-0-E	Main Engine Room	EM	0.04	0.04	0.05	0.05	0.49	0.50	0.76	0.82
3-15-0-E	Hydraulic Equipment Room	QA	0.03	0.03	0.06	0.06	0.03	0.03	0.08	0.08
01-50-0-C	Buoy Deck Control Room	C	0.03	0.06	0.09	0.24	0.06	0.12	0.34	0.60
3-57-1-Q	Elec Shop	QS	0.02	0.02	0.05	0.05	0.12	0.12	0.29	0.29
3-79-0-Q	Pump Room	QA	0.02	0.02	0.04	0.04	0.11	0.11	0.21	0.21
02-61-1-Q	PFD Locker	AG	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
02-61-2-Q	PFD Locker	AG	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
1-0-0-Q	Boatswain Locker	AG	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.02
01-70-1-Q	Boat Locker	AG	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.02
1-6-1-Q	Service Locker	QS	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1-79-1-L	Enlisted SR (4)	L5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-24-0-AA	Cargo Hold	AA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.3.3.4. Alternative #4: Remove One Engine Room Automated Fire Protection System

The preliminary design of the WLM(R) specifies that a total flooding CO_2 system and an AFFF bilge sprinkling system will be installed in the Engine Room. The nine classes of Coast Guard Cutters studied previously had one automated/fixed fire protection system in the Engine Room or none at all. The resulting probabilities of fire extinguishment (A values) in the Engine Room of the WLM(R) are significantly higher than other Coast Guard Cutters as a result of this redundancy. Installing two systems, however, results in the Coast Guard incurring the direct costs of the additional equipment and the indirect costs associated with maintenance of two systems. In addition there is a weight penalty for the added equipment and piping systems. Presumably these costs are worth the benefit. In order to evaluate the benefit gained from the redundant system the probabilities of fire extinguishment (A values) in the Engine Room were reevaluated to reflect the existence of only one automated system. Since SAFE accumulates results from all fire paths from all possible rooms of origin, it was expected that the Engine Room would be most affected by this alternative, but other compartments could also be affected where the Engine Room was the room of origin. Table 3.7 tabulates the results for running the probabilistic model on this alternative data set.

Since historical records indicate that a flammable liquid fire occurs more frequently (than a class Alpha or class Charlie) in an Engine Room and that class Bravo fires usually result in more fire damage, probabilities of extinguishment used in the baseline analysis were determined based on the occurrence of a class Bravo fire. In the Baseline, the RLF for the Engine Room with I, A & M in effect and with I & A in effect were .04 and .05 respectively. These RLFS increase to .26 and .39 respectively if only one automated system were in effect instead of redundant systems (both systems are effective against a class Bravo fire). Thus, results indicate a decreased, but nevertheless acceptable, fire safety level in the Engine Room. The results also show that all compartments meet FSOS, as they do in the baseline with passive, automated and manual fire protection in effect. **Therefore, due to the relatively high effectiveness of either of these automated total flooding systems against a class Bravo fire threat, there is justification for eliminating one of the two automated systems. It should be noted however that a total flooding CO_2 system is considered more effective than an automated AFFF sprinkling system against a class Charlie fire. Therefore, there is justification to retain both automated systems to combat the class Bravo and class Charlie fires that may occur in an Engine Room.** As this analysis is based on a "design" review which has a higher level of consistency in the results, it is recommended that the conservative retention of both systems be maintained.

Table 3.7 Relative loss Factors (RLF) Baseline and Alternative #4 Data Sets

			I/A/M		I/A		I/M		I Only	
			Scenario 1		Scenario 4		Scenario 7		Scenario 10	
Plan ID	Compartment Name	CUI	Baseline	Alt 4	Baseline	Alt 4	Baseline	Alt 4	Baseline	Alt 4
	Run No.		6-2	6M-66	6-5	6M-67	6-8	6M-68	6-11	6M-69
1-6-3-Q	Paint Locker	K	0.41	0.41	0.84	0.84	0.52	0.52	1.09	1.09
02-61-0-C	Chart Room	QO	0.38	0.57	0.97	1.89	0.89	0.89	3.08	3.08
02-70-0-Q	Stack	TU	0.21	0.38	0.46	1.01	0.60	0.60	1.65	1.65
1-70-1-Q	Uptake	TU	0.16	0.28	0.29	0.48	0.43	0.43	0.73	0.73
02-68-2-E	Emergency Generator Room	QE	0.16	0.21	0.31	0.49	0.49	0.49	1.26	1.26
02-52-0-C	Pilothouse	C	0.15	0.18	0.38	0.49	0.23	0.23	0.68	0.68
1-61-0-L	Mess Room	LL	0.15	0.38	0.35	0.95	0.61	0.61	1.56	1.56
1-76-2-Q	Scullery	QG	0.10	0.33	0.19	0.67	0.55	0.55	1.14	1.14
3-6-0-E	Bow Thruster Room	EM	0.09	0.09	0.15	0.15	0.12	0.12	0.20	0.20
1-61-2-Q	Galley	QG	0.06	0.15	0.10	0.26	0.25	0.25	0.42	0.42
3-88-0-E	Propulsion Thruster Room	QA	0.05	0.07	0.11	0.17	0.14	0.14	0.36	0.36
1-6-2-Q	ATON Shop	QS	0.05	0.05	0.10	0.10	0.07	0.07	0.13	0.13
02-68-1-Q	Battery Locker	AG	0.04	0.04	0.05	0.05	0.04	0.04	0.05	0.05
3-52-0-C	Engineering Control Center	C	0.04	0.12	0.07	0.21	0.20	0.20	0.35	0.35
3-61-0-E	Main Engine Room	EM	0.04	0.26	0.05	0.39	0.49	0.49	0.76	0.76
3-15-0-E	Hydraulic Equipment Room	QA	0.03	0.03	0.06	0.06	0.03	0.03	0.08	0.08
01-50-0-C	Buoy Deck Control Room	C	0.03	0.05	0.09	0.21	0.06	0.06	0.34	0.34
3-57-1-Q	Elec Shop	QS	0.02	0.07	0.05	0.17	0.12	0.12	0.29	0.29
3-79-0-Q	Pump Room	QA	0.02	0.05	0.04	0.10	0.11	0.11	0.21	0.21
02-61-1-Q	PFD Locker	AG	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
02-61-2-Q	PFD Locker	AG	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
1-0-0-Q	Boatswain Locker	AG	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.02
01-70-1-Q	Boat Locker	AG	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.02
1-6-1-Q	Service Locker	QS	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1-79-1-L	Enlisted SR (4)	L5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-24-0-AA	Cargo Hold	AA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.3.3.5. Alternative #5: Remove Derating of Bulkhead Between Chart Room and Emergency Gen. Room

The probabilities of limiting the fire due to a Tbar or Dbar failure are plotted versus heat energy impact for certain bulkhead and deck materials in the catalog of barrier materials associated with SAFE. To account for non-standard thicknesses of actual barriers, the thermal strength of the barrier can be altered by adjusting the Tbar or Dbar values. Accordingly, the Tbar and Dbar values for the bulkhead between the Chart Room and the Emergency Generator Room (among others) was modified by decreasing Tbar values by 10% and Dbar values by 8% to account for the fact that the actual bulkhead thickness is 1/4" versus 3/8" in the catalog. The baseline results showed a relatively high RLF in the Chart Room, although it is still considered well within the acceptable range. A detailed analysis showed that many of the fire paths entered the Chart Room through a failure of the bulkhead to the Emergency Generator Room. Thus it was hypothesized that the fire safety in the Chart Room could be improved by "strengthening" this bulkhead. Physically, this would necessitate installing a thicker or more fire-resistant bulkhead. In SAFE, this alternative was modeled by removing the derating of this bulkhead thus simulating a stronger barrier.

The results of running the probabilistic model on this alternative data set are shown in Table 3.8. As expected, "safer" results are shown in the Chart Room and Emergency Generator Room compared to the baseline, with all other compartments unchanged with passive, automated and manual fire protection in effect. With passive and automated fire protection in effect, RLFS also decreased (fire safety increased) in the Chart Room and Emergency Generator Room. With just passive fire protection in effect, fire safety increased (RLFS decreased) in the Emergency Generator Room, Chart Room, and Pilothouse. **The improvements in fire safety however, are considered so slight that requiring a change in the construction of the ship is not warranted.**

Table 3.8 Relative loss Factors (RLF) Baseline and Alternative #5 Data Sets

			I/A/M		I/A		I/M		I Only	
			Scenario 1		Scenario 4		Scenario 7		Scenario 10	
Plan ID	Compartment Name	CUI	Baseline	Alt 5	Baseline	Alt 5	Baseline	Alt 5	Baseline	Alt 5
	Run No.		6-2	6M-42	6-5	6M-43	6-8	6M-44	6-11	6M-45
1-6-3-Q	Paint Locker	K	0.41	0.41	0.84	0.84	0.52	0.52	1.09	1.09
02-61-0-C	Chart Room	QO	0.38	0.34	0.97	0.89	0.89	0.82	3.08	2.93
02-70-0-Q	Stack	TU	0.21	0.21	0.46	0.46	0.60	0.60	1.65	1.65
1-70-1-Q	Uptake	TU	0.16	0.16	0.29	0.29	0.43	0.43	0.73	0.73
02-68-2-E	Emergency Generator Room	QE	0.16	0.15	0.31	0.29	0.49	0.48	1.26	1.23
02-52-0-C	Pilothouse	C	0.15	0.15	0.38	0.38	0.23	0.23	0.68	0.67
1-61-0-L	Mess Room	LL	0.15	0.15	0.35	0.35	0.61	0.61	1.56	1.56
1-76-2-Q	Scullery	QG	0.10	0.10	0.19	0.19	0.55	0.55	1.14	1.14
3-6-0-E	Bow Thruster Room	EM	0.09	0.09	0.15	0.15	0.12	0.12	0.20	0.20
1-61-2-Q	Galley	QG	0.06	0.06	0.10	0.10	0.25	0.25	0.42	0.42
3-88-0-E	Propulsion Thruster Room	QA	0.05	0.05	0.11	0.11	0.14	0.14	0.36	0.36
1-6-2-Q	ATON Shop	QS	0.05	0.05	0.10	0.10	0.07	0.07	0.13	0.13
02-68-1-Q	Battery Locker	AG	0.04	0.04	0.05	0.05	0.04	0.04	0.05	0.05
3-52-0-C	Engineering Control Center	C	0.04	0.04	0.07	0.08	0.20	0.20	0.35	0.37
3-61-0-E	Main Engine Room	EM	0.04	0.04	0.05	0.05	0.49	0.49	0.76	0.76
3-15-0-E	Hydraulic Equipment Room	QA	0.03	0.03	0.06	0.06	0.03	0.03	0.08	0.08
01-50-0-C	Buoy Deck Control Room	C	0.03	0.03	0.09	0.09	0.06	0.06	0.34	0.34
3-57-1-Q	Elec Shop	QS	0.02	0.02	0.05	0.05	0.12	0.12	0.29	0.29
3-79-0-Q	Pump Room	QA	0.02	0.02	0.04	0.04	0.11	0.11	0.21	0.21
02-61-1-Q	PFD Locker	AG	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
02-61-2-Q	PFD Locker	AG	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
1-0-0-Q	Boatswain Locker	AG	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.02
01-70-1-Q	Boat Locker	AG	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.02
1-6-1-Q	Service Locker	QS	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1-79-1-L	Enlisted SR (4)	L5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-24-0-AA	Cargo Hold	AA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.3.3.6. Alternative #6: Add AFFF System to Emergency Generator Room

Since improving the barrier between the Chart Room and the Emergency Generator Room did not substantially improve the fire safety levels of either space it was hypothesized that significantly improving fire protection in the Emergency Generator Room may have the desired effect of improving the fire safety in the Chart Room. To model this alternative the probabilities of extinguishing the fire with automated systems were improved to similar values for the redundant systems presently installed in the Engine Room. No other changes to fire protection systems or their associated probabilities of extinguishment were changed for any other compartment.

Results shown in Table 3.9 are totally consistent with expectations. Fire safety in the Emergency Generator Room is significantly improved (although it should be noted that fire safety was considered acceptable in the baseline) with passive, automated and manual fire protection in effect. In addition, the fire safety was also improved in the Chart Room, Pilot House, Stack, Uptake, Main Engine Room and Galley because many of the fire paths that otherwise would involve (or spread to) these spaces are eliminated by better fire protection in the Emergency Generator Room. Similar results are also seen with passive and automated fire protection in effect. **The slight increase in fire safety of the Chart Room does not justify the expense of installing a redundant automated fire protection system in the Emergency Generator Room, especially considering that both compartments meet fire safety objectives by a substantial margin with the proposed design.**

Table 3.9 Relative loss Factors (RLF) Baseline and Alternative #6 Data Sets

			I/A/M		I/A		I/M		I Only	
			Scenario 1		Scenario 4		Scenario 7		Scenario 10	
Plan ID	Compartment Name	CUI	Baseline	Alt 6	Baseline	Alt 6	Baseline	Alt 6	Baseline	Alt 6
	Run No.		6-2	6M-46	6-5	6M-47	6-8	6M-48	6-11	6M-49
1-6-3-Q	Paint Locker	K	0.41	0.41	0.84	0.84	0.52	0.52	1.09	1.09
02-61-0-C	Chart Room	QO	0.38	0.25	0.97	0.72	0.89	0.89	3.08	3.08
02-70-0-Q	Stack	TU	0.21	0.15	0.46	0.37	0.60	0.60	1.65	1.65
1-70-1-Q	Uptake	TU	0.16	0.12	0.29	0.22	0.43	0.43	0.73	0.73
02-68-2-E	Emergency Generator Room	QE	0.16	0.02	0.31	0.02	0.49	0.49	1.26	1.26
02-52-0-C	Pilothouse	C	0.15	0.13	0.38	0.31	0.23	0.23	0.68	0.68
1-61-0-L	Mess Room	LL`	0.15	0.15	0.35	0.35	0.61	0.61	1.56	1.56
1-76-2-Q	Scullery	QG	0.10	0.10	0.19	0.19	0.55	0.55	1.14	1.14
3-6-0-E	Bow Thruster Room	EM	0.09	0.09	0.15	0.15	0.12	0.12	0.20	0.20
1-61-2-Q	Galley	QG	0.06	0.05	0.10	0.10	0.25	0.25	0.42	0.42
3-88-0-E	Propulsion Thruster Room	QA	0.05	0.05	0.11	0.11	0.14	0.14	0.36	0.36
1-6-2-Q	ATON Shop	QS	0.05	0.05	0.10	0.10	0.07	0.07	0.13	0.13
02-68-1-Q	Battery Locker	AG	0.04	0.04	0.05	0.05	0.04	0.04	0.05	0.05
3-52-0-C	Engineering Control Center	C	0.04	0.04	0.07	0.07	0.20	0.20	0.35	0.35
3-61-0-E	Main Engine Room	EM	0.04	0.03	0.05	0.04	0.49	0.49	0.76	0.76
3-15-0-E	Hydraulic Equipment Room	QA	0.03	0.03	0.06	0.06	0.03	0.03	0.08	0.08
01-50-0-C	Buoy Deck Control Room	C	0.03	0.03	0.09	0.09	0.06	0.06	0.34	0.34
3-57-1-Q	Elec Shop	QS	0.02	0.02	0.05	0.05	0.12	0.12	0.29	0.29
3-79-0-Q	Pump Room	QA	0.02	0.02	0.04	0.04	0.11	0.11	0.21	0.21
02-61-1-Q	PFD Locker	AG	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
02-61-2-Q	PFD Locker	AG	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
1-0-0-Q	Boatswain Locker	AG	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.02
01-70-1-Q	Boat Locker	AG	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.02
1-6-1-Q	Service Locker	QS	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1-79-1-L	Enlisted SR (4)	L5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-24-0-AA	Cargo Hold	AA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.3.3.7. Alternative #7: Combine alternatives #4 and #6

Alternative #4 examined the effect of removing one of the two automated systems from the Engine Room and alternative #6 studied the effect of adding a second redundant system in the Emergency Generator Room. Both of these alternatives were studied in isolation, combining these two alternatives would model the effect of requiring the installation of a redundant fire protection system in the Emergency Generator Room instead of the Engine Room. To model this alternative the probabilities of automatically extinguishing the fire in the Emergency Generator Room were raised to the present values assigned to the Engine Room and the Engine Room values were lowered to match those presently assigned to the Emergency Generator Room. Results of running the probabilistic model on this combined alternative is shown in Table 3.10.

As expected, the results show that removing the redundant automated system from the Engine Room caused 12 compartments to become less fire safe while adding a redundant system to the Emergency Generator Room increased fire safety in the Emergency Generator Room only (with passive, automated, and manual fire protection in effect). The relative magnitude of improvement or degradation was approximately equal and not considered particularly dramatic. There is a higher fuel load and a higher frequency of EB in the Engine Room compared to the Emergency Generator Room. Moreover the Engine Room is lower in the ship and fire has a propensity to travel upward, thus there are more potential compartments in harm's way from an Engine Room fire than from a fire in the Emergency Generator Room. **Hence, removing the redundant system from the Engine Room is more harmful to the overall fire safety of the cutter than adding a redundant system to the Emergency Generator Room is beneficial. Therefore, if the Coast Guard can afford the luxury of only one redundant automated fire protection system, it should be installed in the Engine Room.**

Table 3.10 Relative loss Factors (RLF) Baseline and Alternative #7 Data Sets

Plan ID	Compartment Name	CUI	I/A/M Scenario 1 Baseline	I/A/M Scenario 1 Alt 7	I/A Scenario 4 Baseline	I/A Scenario 4 Alt 7	I/M Scenario 7 Baseline	I/M Scenario 7 Alt 7	I Only Scenario 10 Baseline	I Only Scenario 10 Alt 7
	Run No.		6-2	6M-50	6-5	6M-51	6-8	6M-52	6-11	6M-53
1-6-3-Q	Paint Locker	K	0.41	0.41	0.84	0.84	0.52	0.52	1.09	1.09
02-61-0-C	Chart Room	QO	0.38	0.44	0.97	1.65	0.89	0.89	3.08	3.08
02-70-0-Q	Stack	TU	0.21	0.32	0.46	0.92	0.60	0.60	1.65	1.65
1-70-1-Q	Uptake	TU	0.16	0.23	0.29	0.41	0.43	0.43	0.73	0.73
02-68-2-E	Emergency Generator Room	QE	0.16	0.02	0.31	0.03	0.49	0.49	1.26	1.26
02-52-0-C	Pilothouse	C	0.15	0.15	0.38	0.43	0.23	0.23	0.68	0.68
1-61-0-L	Mess Room	LL	0.15	0.38	0.35	0.95	0.61	0.61	1.56	1.56
1-76-2-Q	Scullery	QG	0.10	0.33	0.19	0.67	0.55	0.55	1.14	1.14
3-6-0-E	Bow Thruster Room	EM	0.09	0.09	0.15	0.15	0.12	0.12	0.20	0.20
1-61-2-Q	Galley	QG	0.06	0.15	0.10	0.26	0.25	0.25	0.42	0.42
3-88-0-E	Propulsion Thruster Room	QA	0.05	0.07	0.11	0.17	0.14	0.14	0.36	0.36
1-6-2-Q	ATON Shop	QS	0.05	0.05	0.10	0.10	0.07	0.07	0.13	0.13
02-68-1-Q	Battery Locker	AG	0.04	0.04	0.05	0.05	0.04	0.04	0.05	0.05
3-52-0-C	Engineering Control Center	C	0.04	0.12	0.07	0.21	0.20	0.20	0.35	0.35
3-61-0-E	Main Engine Room	EM	0.04	0.24	0.05	0.36	0.49	0.49	0.76	0.76
3-15-0-E	Hydraulic Equipment Room	QA	0.03	0.03	0.06	0.06	0.03	0.03	0.08	0.08
01-50-0-C	Buoy Deck Control Room	C	0.03	0.05	0.09	0.21	0.06	0.06	0.34	0.34
3-57-1-Q	Elec Shop	QS	0.02	0.07	0.05	0.17	0.12	0.12	0.29	0.29
3-79-0-Q	Pump Room	QA	0.02	0.05	0.04	0.10	0.11	0.11	0.21	0.21
02-61-1-Q	PFD Locker	AG	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
02-61-2-Q	PFD Locker	AG	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
1-0-0-Q	Boatswain Locker	AG	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.02
01-70-1-Q	Boat Locker	AG	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.02
1-6-1-Q	Service Locker	QS	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1-79-1-L	Enlisted SR (4)	L5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-24-0-AA	Cargo Hold	AA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.3.3.8. Alternative #8: All T/D Adjust Values to -30%

Typical cutters in the Coast Guard remain in service well over thirty years - some for as long as fifty years. Over the years, the crew from time to time will drill holes in the barriers to accommodate electrical wiring or piping. After a period of time, various equipment's are removed but the holes frequently remain in the barriers. Furthermore, the salt air atmosphere tends to degrade the integrity due to corrosion over the years. Thus a bulkhead or deck is not as fire resistive in the cutter's later years as they are when the ship is new. This degradation is accounted for in SAFE by the user/analyst entering a T-adjust or D-adjust value of between 0 and -30%. In the WLM(R) no degradation was assumed since the ship is new. The methodology permits an evaluation of the effect of long term slow degradation. This was evaluated by setting all "T-adjust" and "D-adjust" values used in the baseline analysis to "-30%" for all barriers. This extreme adjustment represents absolute worse case and although no cutter's barriers have ever been considered this poor, this alternative will produce conservative results. Table 3.11 shows the results of running the probabilistic model on this alternative data set.

With passive, automated and manual fire protection in effect, fire safety is degraded in 10 compartments and improved in 2 compared to the baseline, while all compartments still meet FSOS. Considering passive and automated fire protection, fire safety is degraded in 13 compartments and improved in 4 compared to the baseline, while all compartments still meet FSOS. With only passive fire protection in effect, fire safety is degraded in 13 compartments and improved in 5 compared to the baseline; two additional compartments compared to the baseline fail to meet FSOS. Improvements in fire safety were not expected and are attributed to the fact that with different barrier fire strengths different fire paths are generated which involve different compartments. **Therefore, considering barrier degradation in isolation, there is no substantial decrease in fire safety of the cutter.**

Table 3.11 Relative loss Factors (RLF) Baseline and Alternative #8 Data Sets

			I/A/M		I/A		I/M		I Only	
			Scenario 1		Scenario 4		Scenario 7		Scenario 10	
Plan ID	Compartment Name	CUI	Baseline	Alt 8	Baseline	Alt 8	Baseline	Alt 8	Baseline	Alt 8
	Run No.		6-2	6M-58	6-5	6M-59	6-8	6M-60	6-11	6M-61
1-6-3-Q	Paint Locker	K	0.41	0.38	0.84	0.74	0.52	0.48	1.09	0.95
02-61-0-C	Chart Room	QO	0.38	0.35	0.97	0.85	0.89	0.87	3.08	2.43
02-70-0-Q	Stack	TU	0.21	0.21	0.46	0.40	0.60	0.51	1.65	1.02
1-70-1-Q	Uptake	TU	0.16	0.20	0.29	0.39	0.43	0.63	0.73	1.29
02-68-2-E	Emergency Generator Room	QE	0.16	0.20	0.31	0.42	0.49	0.68	1.26	1.93
02-52-0-C	Pilothouse	C	0.15	0.23	0.38	0.61	0.23	0.35	0.68	1.19
1-61-0-L	Mess Room	LL	0.15	0.17	0.35	0.41	0.61	0.63	1.56	1.50
1-76-2-Q	Scullery	QG	0.10	0.10	0.19	0.20	0.55	0.55	1.14	1.15
3-6-0-E	Bow Thruster Room	EM	0.09	0.09	0.15	0.16	0.12	0.12	0.20	0.21
1-61-2-Q	Galley	QG	0.06	0.08	0.10	0.15	0.25	0.38	0.42	0.72
3-88-0-E	Propulsion Thruster Room	QA	0.05	0.06	0.11	0.12	0.14	0.15	0.36	0.38
1-6-2-Q	ATON Shop	QS	0.05	0.05	0.10	0.10	0.07	0.07	0.13	0.13
02-68-1-Q	Battery Locker	AG	0.04	0.05	0.05	0.08	0.04	0.05	0.05	0.08
3-52-0-C	Engineering Control Center	C	0.04	0.04	0.07	0.10	0.20	0.21	0.35	0.38
3-61-0-E	Main Engine Room	EM	0.04	0.04	0.05	0.05	0.49	0.50	0.76	0.79
3-15-0-E	Hydraulic Equipment Room	QA	0.03	0.03	0.06	0.06	0.03	0.03	0.08	0.08
01-50-0-C	Buoy Deck Control Room	C	0.03	0.06	0.09	0.24	0.06	0.13	0.34	0.72
3-57-1-Q	Elec Shop	QS	0.02	0.02	0.05	0.04	0.12	0.07	0.29	0.17
3-79-0-Q	Pump Room	QA	0.02	0.02	0.04	0.04	0.11	0.11	0.21	0.21
02-61-1-Q	PFD Locker	AG	0.02	0.03	0.02	0.03	0.02	0.03	0.02	0.03
02-61-2-Q	PFD Locker	AG	0.02	0.03	0.02	0.03	0.02	0.03	0.02	0.03
1-0-0-Q	Boatswain Locker	AG	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.02
01-70-1-Q	Boat Locker	AG	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.02
1-6-1-Q	Service Locker	QS	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1-79-1-L	Enlisted SR (4)	L5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-24-0-AA	Cargo Hold	AA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.3.3.9. Alternative #9: Combine alternatives #1,2,3,4, and 8

Studying the various alternatives discussed above is a form of a sensitivity study. In a true sensitivity study only one variable is allowed to change, in this analysis changing more than one variable is frequently required to properly model an alternative. As noted in the above discussions it does not appear that any one alternative caused a severe enough decrease in fire safety to be a concern by itself. However, to study the cumulative effect of multiple changes that may adversely affect fire safety an alternative that combines the following, previously studied alternatives was modeled:

- Reduce Percent Monitored to that shown in Table 3.2
- Remove All Insulation from all Barriers
- Assume All Windows Lost
- Remove One Engine Room Automated Fire Protection System
- Degrade all barriers by setting all T/D Adjust Values to -30%

The results of running the probabilistic model on this alternative data set is shown in Table 3.12. As expected, the cumulative results show a significant decrease in the overall fire safety levels compared to the baseline. With passive, automated and manual fire protection in effect, the ship still meets FSOS in all compartments, but the Chart Room is only marginally acceptable (in the baseline all compartments met FSOS by a substantial margin). Considering passive and automated fire protection only, six compartments fail to meet FSOS and three others are only marginally acceptable (in the baseline only one compartment was marginally acceptable, all others met FSOS). With Passive fire protection only in effect, 10 compartments fail to meet FSOS and one additional compartment is only marginally acceptable (in the baseline 6 compartments failed to meet FSOS). **Therefore it appears that the fire safety on this cutter is so good that it actually takes a combination of adverse effects before there is a significant decrease in overall fire safety.**

Table 3.12 Relative loss Factors (RLF) Baseline and Alternative #9 Data Sets

			I/A/M		I/A		I/M		I Only	
			Scenario 1		Scenario 4		Scenario 7		Scenario 10	
Plan ID	Compartment Name	CUI	Baseline	Alt 9	Baseline	Alt 9	Baseline	Alt 9	Baseline	Alt 9
	Run No.		6-2	6M-62	6-5	6M-63	6-8	6M-64	6-11	6M-65
1-6-3-Q	Paint Locker	K	0.41	0.48	0.84	0.90	0.52	0.58	1.09	1.11
02-61-0-C	Chart Room	QO	0.38	0.96	0.97	3.10	0.89	1.50	3.08	4.89
02-70-0-Q	Stack	TU	0.21	0.42	0.46	1.10	0.60	0.63	1.65	1.63
1-70-1-Q	Uptake	TU	0.16	0.57	0.29	1.52	0.43	0.89	0.73	2.38
02-68-2-E	Emergency Generator Room	QE	0.16	0.33	0.31	0.98	0.49	0.76	1.26	2.40
02-52-0-C	Pilothouse	C	0.15	0.80	0.38	3.31	0.23	1.17	0.68	4.91
1-61-0-L	Mess Room	LL	0.15	0.45	0.35	1.21	0.61	0.73	1.56	2.08
1-76-2-Q	Scullery	QG	0.10	0.41	0.19	0.97	0.55	0.68	1.14	1.66
3-6-0-E	Bow Thruster Room	EM	0.09	0.09	0.15	0.16	0.12	0.13	0.20	0.22
1-61-2-Q	Galley	QG	0.06	0.32	0.10	0.77	0.25	0.50	0.42	1.20
3-88-0-E	Propulsion Thruster Room	QA	0.05	0.11	0.11	0.33	0.14	0.21	0.36	0.73
1-6-2-Q	ATON Shop	QS	0.05	0.12	0.10	0.20	0.07	0.14	0.13	0.23
02-68-1-Q	Battery Locker	AG	0.04	0.18	0.05	0.29	0.04	0.26	0.05	0.43
3-52-0-C	Engineering Control Center	C	0.04	0.15	0.07	0.39	0.20	0.26	0.35	0.70
3-61-0-E	Main Engine Room	EM	0.04	0.28	0.05	0.49	0.49	0.54	0.76	0.95
3-15-0-E	Hydraulic Equipment Room	QA	0.03	0.03	0.06	0.07	0.03	0.03	0.08	0.08
01-50-0-C	Buoy Deck Control Room	C	0.03	0.24	0.09	1.44	0.06	0.37	0.34	2.38
3-57-1-Q	Elec Shop	QS	0.02	0.10	0.05	0.18	0.12	0.16	0.29	0.30
3-79-0-Q	Pump Room	QA	0.02	0.06	0.04	0.13	0.11	0.13	0.21	0.28
02-61-1-Q	PFD Locker	AG	0.02	0.10	0.02	0.20	0.02	0.12	0.02	0.27
02-61-2-Q	PFD Locker	AG	0.02	0.22	0.02	0.47	0.02	0.33	0.02	0.74
1-0-0-Q	Boatswain Locker	AG	0.01	0.05	0.02	0.07	0.01	0.05	0.02	0.07
01-70-1-Q	Boat Locker	AG	0.01	0.04	0.02	0.11	0.01	0.05	0.02	0.18
1-6-1-Q	Service Locker	QS	0.01	0.07	0.01	0.16	0.01	0.09	0.01	0.20
1-79-1-L	Enlisted SR (4)	L5	0.00	0.02	0.00	0.06	0.00	0.03	0.00	0.09
2-24-0-AA	Cargo Hold	AA	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.01

3.3.4. COST-BENEFIT ANALYSIS

The goal of the fire safety analysis is to maximize the benefit (improvement in fire safety), while minimizing the cost (dollars and other intangible factors) of the changes. Thus, a cost-benefit analysis is considered a vital part of a fire safety analysis. Within the constraints of time and allowable funds, as many alternatives are analyzed as possible to permit a useful cost benefit analysis of the alternatives studied.

Since all compartments in the WLM(R) exceed minimal FSOS, no improvements are required to bring the ship up to minimally acceptable standards. Accordingly, a cost benefit-analysis of alternatives is not applicable for the WLM(R).

It is not considered appropriate to conduct a cost benefit analysis of alternatives to reduce the level of fire safety, while still meeting all FSOS. The uncertainty in conducting the analysis of a "design" vessel versus that of an "existing" vessel does not warrant a cost benefit analysis in this condition.

4. FIRE PROTECTION DOCTRINE

4.1. BACKGROUND

4.1.1. MAIN SPACE FIREFIGHTING DOCTRINE

The Main Space Firefighting Doctrine, published as Commandant Instruction M9555.1, applies to class B fires in the machinery spaces on all Coast Guard cutters 65' and greater in length. The purpose of this doctrine is to delineate the tactics, philosophy, and procedures associated with the use and operation of the various firefighting systems and equipment on board the cutter for combating machinery space fires. The doctrine is structured to provide a basis for the proper actions and decisions of the firefighting crew and the considerations necessary in choosing the correct firefighting equipment and agent. The doctrine also defines personnel responsibilities and scenarios such as a major oil leak which could result in a class B fire.

The main space firefighting doctrine for Coast Guard cutters was written in a general manner to apply to all floating units. It was designed primarily for the larger cutters; smaller cutters were supposed to tailor the doctrine to suit their individual needs. The doctrine is difficult to tailor to suit the needs of the small cutter which has considerably different crew size, state of training and installed equipment compared to the larger cutters. Finally, the format of the doctrine was organized such that general information pertaining to fire science, guidance from the Commandant and other authorities, and specific tactical procedures for a particular cutter were mixed throughout the document. Consequently, an objective of the SCFP project is to provide a firefighting doctrine designed primarily for the needs of the small cutter.

4.1.2. FIRE PROTECTION DOCTRINE

Prior to this report, nine classes of small Coast Guard cutters have been analyzed in the SCFP project. A fire protection doctrine has been developed which is tailored to each class of cutter; only minor changes are required for each cutter in the class to account for uncompleted SHIPALTS, changes in compartmentation due to different subclasses, etc. The format of the new doctrine is significantly different than the format of the Main Space Firefighting Doctrine. In addition, the new doctrine includes procedures for combating all classes of fire in all types of compartments. The following sections describe the format and scope of the new fire protection doctrine as well as procedures for maintaining this document.

4.1.2.1. Fire Protection Doctrine Format

The new fire protection doctrine is organized into three parts. Part A includes information and facts concerning fire science and firefighting such as the effectiveness of various firefighting agents on the different classes of fires. This part applies equally to all cutters (large and small) and rarely changes over time. The development of a new firefighting agent would be an occasion worthy of updating Part A. Note this revision would not require the use of that agent on any particular ship.

Part B incorporates guidance promulgated by the Commandant, U. S. Coast Guard. The format of this new doctrine calls for two different versions of Part B - one applicable to small cutters (less than 180' in length) and the other applicable to large cutters (180' and greater in length). This distinction is based on several factors including crew size, type of hazard due to main propulsion equipment, quantity and timeliness of support likely to be available, and area of operations. At the Commandant's discretion, portions of Part B may be similar for both large and small cutters. Circumstances for activating a gas turbine enclosure local fire extinguishing system is an example of guidance the Commandant would provide in Part B for large cutters only since gas turbines are not used on small cutters. On the other hand, since crew members on board small cutters are generally able to safely abandon ship due to their proximity to shore, the Commandant may provide guidance of when that would be appropriate for small cutters only.

Part C contains the tactical procedures to combat all classes of fires, in all types of compartments, in port and at sea. This part was originally developed for a representative cutter for each class. Other cutters in the class will have to tailor this part to account for uncompleted (or unauthorized) SHIPALTS and other differences that would require different tactics. **The Commanding Officer of the cutter has the responsibility to ensure this tailoring is accomplished in a timely manner and that such changes do not contradict the guidance provided in Parts A and B.**

4.1.2.2. Scope

This report provides a tailored fire protection doctrine, documented in Appendix E of this report, for the preliminary design of the U. S. Coast Guard Replacement Coastal Buoy Tender (WLM(R)). Parts A and B of the WLM(R) fire protection doctrine, included in Appendix E to this report were previously developed as part of the SCFP and are also included in the fire protection doctrine for the nine classes of cutters analyzed in the SCFP.

The fire protection doctrines developed for the nine classes of small cutters previously studied in the SCFP included firefighting procedures for every accessible compartment. This approach is impractical for the larger WLM(R) due to the fact there are 65 accessible compartments in the cutter. The individual compartments selected for development of firefighting procedures were limited to those which met one or more of the following criteria:

- Access or egress routes may not be immediately obvious
- Unusual firefighting tactics may be necessary to deal with conditions that exist in the compartment
- Firefighting procedures for each class of fire are desired in the doctrine
- The compartment has a relatively high historic frequency of EB
- The fuel loads or fuel load densities are considered relatively high compared to other compartments
- Compartments with fuel loads that exhibit extremely fast fire growth characteristics
- Compartments designated as engineering spaces

- Compartments with automated fire protection systems installed
- A typical compartment in each major section of the cutter

4.1.2.3. Future Revisions

Part A of the doctrine presents facts concerning the principles of fire science and other facts and information to enable a crew member to make the proper selection of firefighting equipment and agents to combat a particular class of fire. Revisions to this part should rarely be required. The introduction of a new firefighting agent or equipment by industry is the most likely scenario that would require updating Part A. This revision is only required if the new agent or equipment is used somewhere in the Coast Guard fleet.

Part B represents guidance from the Commandant and other Naval authorities applicable to either large cutters or small cutters. Recent conflagrations on the USS STARK and USS ROBERTS provided many lessons learned; these fires are examples of scenarios that would likely result in new or additional guidance provided to the fleet.

Changes to Part C will usually be required in the event of SHIPALTS that affect the firefighting capabilities or compartmentation of the Cutter. In addition, new Commanding Officers are likely to change Part C (within the constraints of Parts A and B) due to their own beliefs, experiences, and desires.

It is expected that the Commandant, U.S. Coast Guard will issue revisions to Parts A and B as necessary, while Commanding Officers will be responsible for revising Part C for their own cutter. The revision page of the doctrine should document the authority who issued the change.

4.2. FIRE PROTECTION DOCTRINE FOR WLM(R)

As noted above, Part C of the doctrine contains ship specific information relative to firefighting procedures on the cutter. Since the WLM(R) is in the preliminary design phase of construction, certain information is not available to complete portions of Part C. Moreover, certain assumptions are made concerning the interpretation of the COR, SOLAS and other requirements which affect the fire safety design of the cutter. **A thorough ship-check will be needed after the ship is delivered to add the missing information where indicated in the doctrine and validate the various assumptions documented in Appendices B and C of this report**. Consequently, the doctrine included in this report as Appendix E is necessarily incomplete, however, the effort required to complete it is considered minimal.

As noted above, due to the large number of compartments on this cutter, there was a need to reduce the number of individual scenarios to a reasonable number that would be described in Part C. Compartments to be included in Part C were identified by applying the criteria discussed in section 4.1.2.2 and shown in Table 4.1. The compartments shown as rows in this table were the compartments that fit one or more of the criteria shown as columns. The number of individual scenarios was thus limited to 18 even though there are 65 accessible compartments in this cutter.

Table 4.1 Criteria for Inclusion in Part C of the Fire Protection Doctrine

	Access or Egress Problems	Unusual Firefighting Tactics Required	FF Procedures for Each Class of Fire	High Frequency of EB	High Fuel Loads or Fuel Load Densities	Engineering Spaces	Automated Fire Protection Systems Installed	Typical Compt in a Major Section of the Ship	Mission Critical Compartment
Emergency Generator Room		¤		¤		¤	¤		
Pilothouse/Chart Room								¤	¤
PFD Locker					¤				
Stack/Uptake		¤				¤			¤
Enlisted Berthing, 01 Deck			¤						
Buoy Deck Control Room									¤
Paint Locker							¤		
Mess Room/Galley							¤	¤	
Ship's Office								¤	
Stateroom 1-79-2-L	¤								
Bow Thruster Room			¤	¤		¤			
Hydraulic Equipment Room						¤			
Cargo Hold					¤			¤	
Machine Shop								¤	
Engineering Control Center									¤
Main Engine Room		¤	¤	¤	¤	¤	¤		¤
Pump Room						¤			
Propulsion Thruster Room					¤	¤			¤

5. CONCLUSIONS AND RECOMMENDATIONS

This report describes the results of the fire safety analysis of the U.S. Coast Guard Replacement Buoy Tender (WLM(R)). This cutter is 175' in length, therefore it is within the scope of the Small Cutter Fire Protection (SCFP) project. There have been four interim and one final technical report submitted to date during the course of the SCFP. [3, 12, 13, 14, 15] The interim reports are not generally available in the literature, however they may be obtained upon request from the Safety and Human Resource Division, U. S. Coast Guard Research and Development Center. Since this is one of two final reports in the project, the conclusions and recommendations presented herein include some of those documented in the other reports submitted previously in the SCFP. Three objectives were established for this project. This section of the report is organized in a manner that correspond to these objectives.

5.1. FIRE SAFETY ANALYSIS OF THE WLM(R)

The first objective in this project is to analyze the fire safety of the proposed design of the WLM(R). As a small cutter, the WLM(R) may be compared to other small cutters in the SCFP. Baseline results in previous analyses of small cutters in the SCFP indicate that fire protection levels in most compartments, with passive, automated and active fire protection features in effect, generally meet Fire Safety Objectives (FSOS). These results are validated by historical records as discussed in section 3.1.2 of this report. Results of the baseline fire safety analysis of the WLM(R) are consistent with the results from previous work in the SCFP. **All compartments in the WLM(R) exceed FSOS by a substantial margin with passive, automated, and manual fire protection features in effect.** These results are shown graphically in Figure 5.1. Even without considering the contribution provided by manual firefighting, the WLM(R) meets FSOS in every compartment (just passive and automated fire protection in effect) as shown in Figure 5.2. As shown in Figure 5.3, only six compartments fail to meet FSOS with just passive fire protection in effect.

A preliminary fire safety analysis of the WLM(R) was conducted in conjunction with a review of the COR and a visit to the Shipyard where the vessel will be constructed. The results of the baseline fire safety analysis using the SFSEM/SAFE precluded the need to study alternatives to improve fire safety in compartments which failed to meet FSOS. Instead, some of the planned fire protection features such as redundant automated fire protection systems in the Engine Room and the comprehensive automatic fire detection system was studied to determine their relative effect on the fire safety of this proposed cutter. The following sections describe the conclusions and recommendations of the preliminary and baseline fire safety analyses and the analysis of the nine alternatives that were studied.

5.1.1. PRELIMINARY FIRE SAFETY ANALYSIS

The preliminary analysis was limited in scope since the ship has not been built. However, a thorough review of the COR, specifications, available drawings, and

discussions with Marinette Marine Shipyard revealed the following conclusions and recommendations:

- The present design calls for two fire pumps to be located in different fire zones, however they share a common sea suction. If the vessel were to be fouled in a kelp bed or go aground there is a strong possibility that both fire pumps could be rendered unusable. It is recommended that each fire pump be served from a different sea chest as widely separated as possible.
- The proposed compartmentation meets or exceeds SOLAS requirements for egress with the exception of the four-person Enlisted Stateroom 1-79-2-L. As shown in Figure A.2 in Appendix A, this stateroom does not presently have two means of egress However, the installation of a kick-out panel in compartment 1-83-2-L, the associated sanitary space for this stateroom, would provide a second means of egress. The second egress route would then start in stateroom 1-79-2-L, proceed through sanitary spaces 1-83-1 and 2-L into stateroom 1-79-1-L and out to weather through the emergency escape scuttle.
- The present design calls for an automated AFFF sprinkler system to be installed in the unmanned Bow Thruster Room. Since the primary fire threat in this compartment is the electrical motor and controller for the bow propulsion unit, it is recommended that consideration be given to changing this system to an installed CO_2 flooding system.

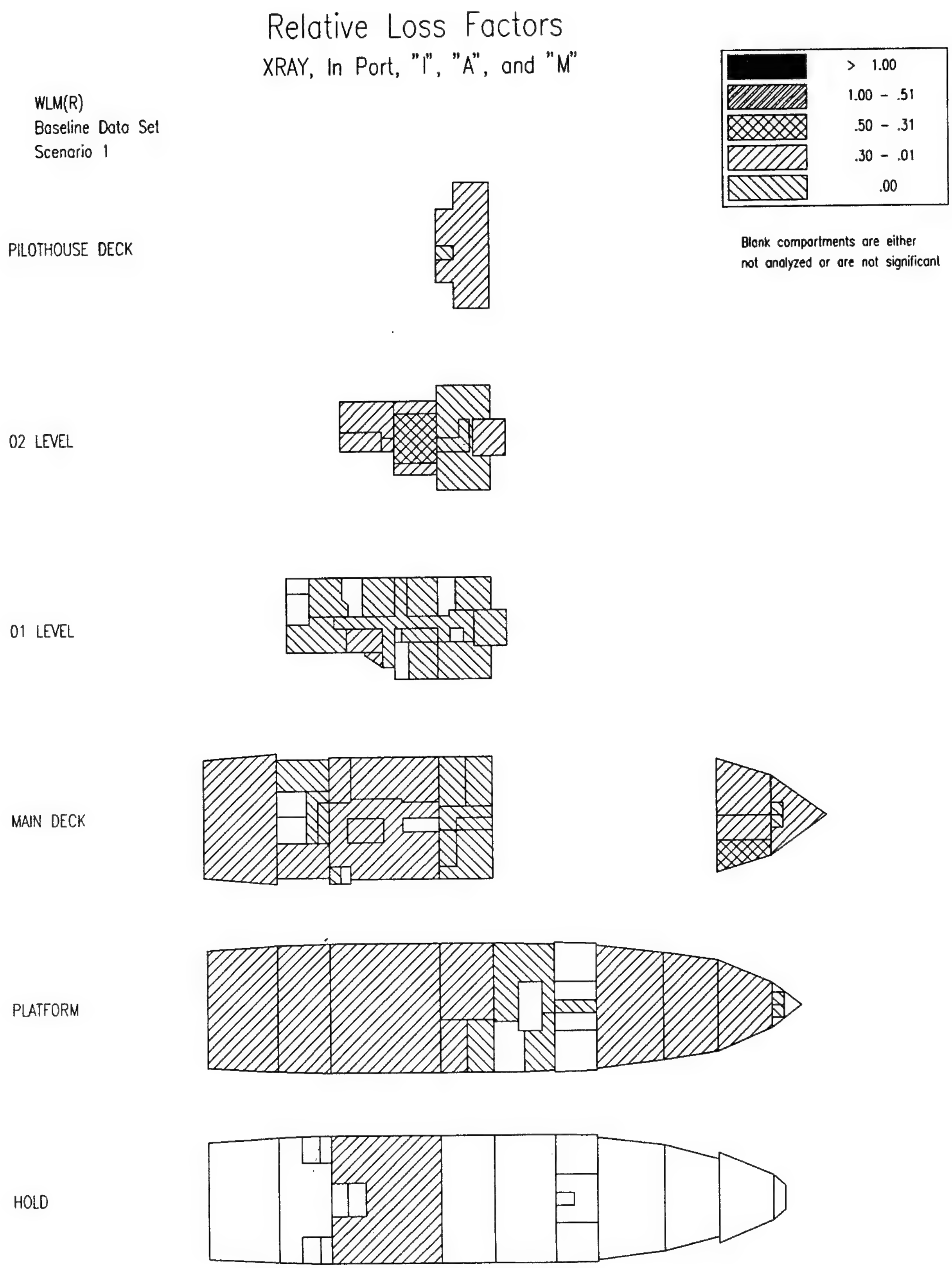

Figure 5.1 Relative Loss Factors, Baseline Scenario 1

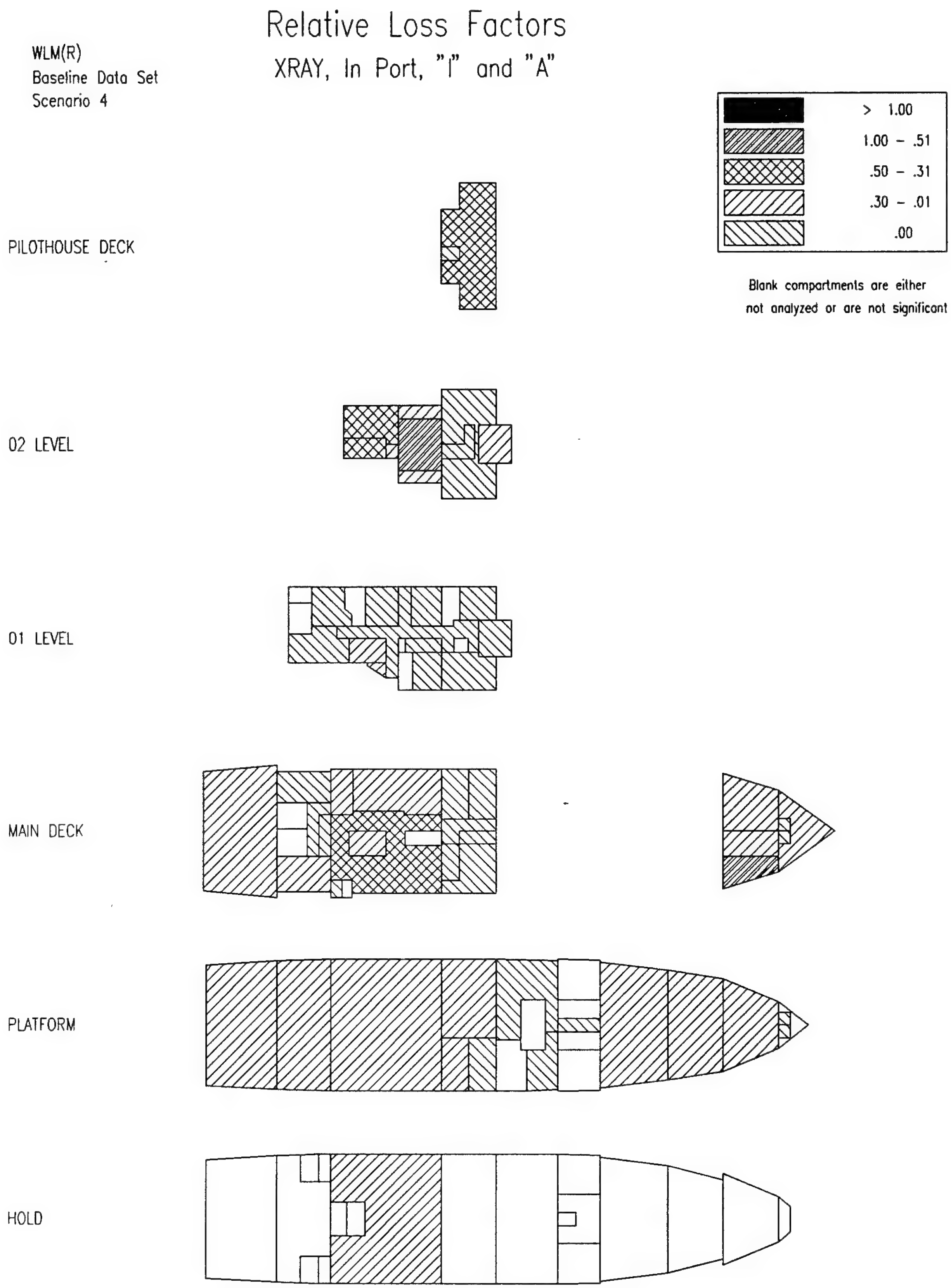

Figure 5.2 Relative Loss Factors, Baseline Scenario 4

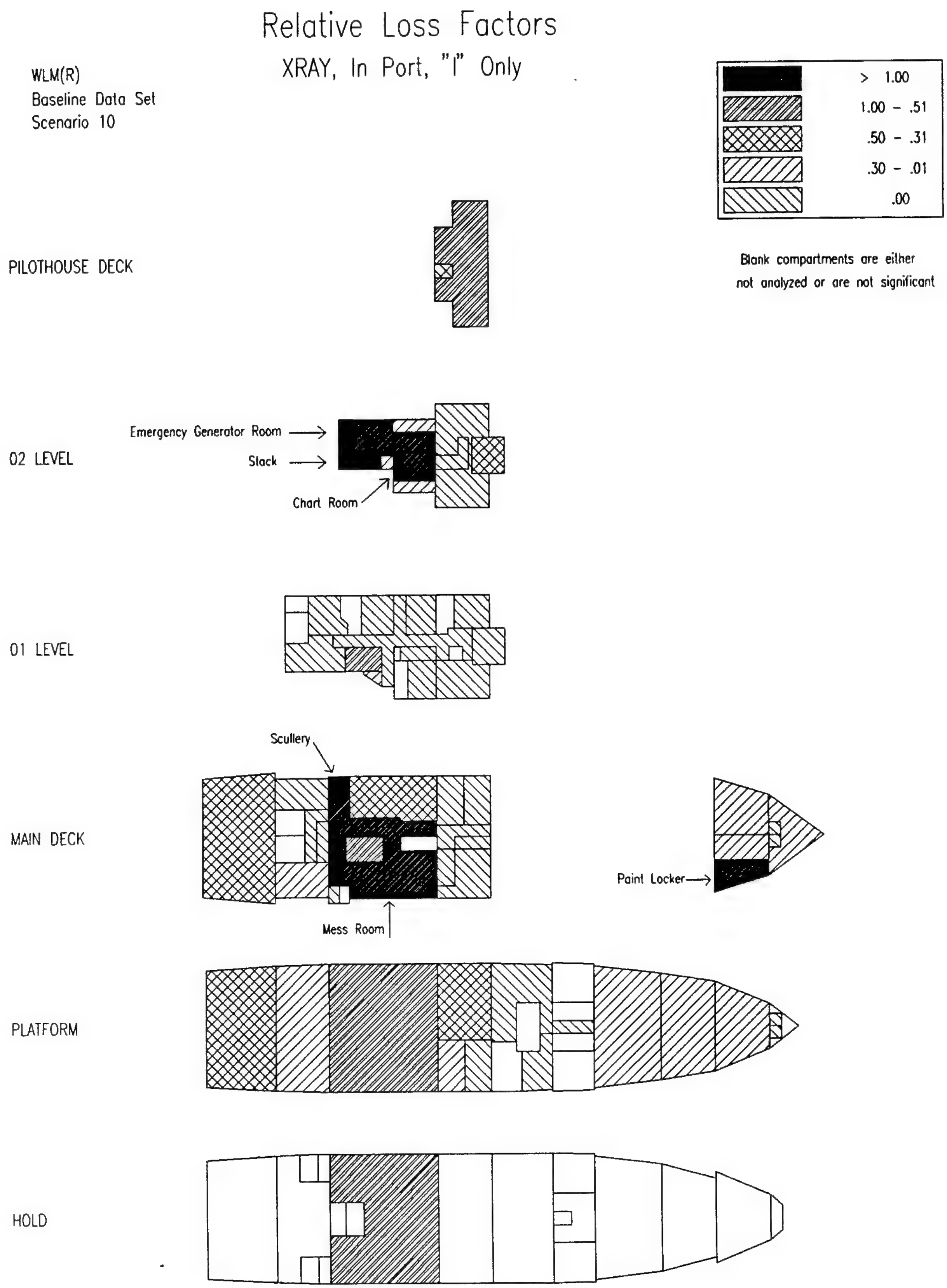

Figure 5.3 Relative Loss Factors, Baseline Scenario 10

5.1.2. BASELINE FIRE SAFETY ANALYSIS

The two classes of existing U.S. Coast Guard Coastal Buoy Tenders had a frequency of reportable fires equal to 1 reportable fire every 19.8 years based on 99 cutter years of data (11 ships over 9 years). Therefore, relatively high fire safety levels are expected in this type of cutter. Based on a thorough baseline fire safety analysis, the very high fire safety levels in the WLM(R) are attributed to the following:

- The Circular of Requirements (COR) and regulations invoked by the COR such as American Bureau of Shipping (ABS), International Convention for Safety of Life at Sea (SOLAS), and Code of Federal Regulations (CFR) specify a high degree of fire safety in the preliminary design.
- Marinette Marine Shipyard and the Coast Guard Resident Inspector Staff are making a concerted effort to consider fire safety in all aspects of design and construction.
- The integrity of the bulkheads and decks which comprise barriers to the spread of fire are not degraded since the ship is new.
- Redundant, automated fixed fire protection systems are installed in the machinery spaces which historically have the highest frequency of Established Burning (EB)
- Fuel loads and fuel load densities, shown in Figures 5.4 and 5.5, are considered generally low compared to other cutters. Moreover, the Frequency of EB shown for each compartment in Figure 5.6, indicates that compartments with a relatively high frequency of EB do not have relatively high fuel load densities.
- The WLM(R) is required to be equipped with an automatic fire detection system that protects virtually every compartment in the cutter; thus early warning of fires and timely setting of Condition ZEBRA is assured in port and at sea.
- Adequate quantities of firefighting equipment are required to be installed throughout the cutter that provide ready access to the appropriate firefighting agent for the anticipated fire threat.
- The compartmentation shown in the preliminary design permits safe and easy access to all spaces for firefighting purposes.
- The preliminary design specifies steel watertight bulkheads and decks (opposed to aluminum which does not withstand fire as well) and non-combustible materials of construction are specified in accordance with the latest regulations such as SOLAS.
- As specified in SOLAS Chapter II-2 part C, Class A-60 bulkheads and decks (passed Standard Time-Temperature Curve fire test) are specified to completely surround spaces such as the repair locker, engine room, stack/uptake, and paint locker, thus isolating or protecting selected spaces as appropriate.

  Insulation is installed throughout the ship to improve the efficiency of the HVAC systems. This insulation also serves a useful fire safety purpose by slowing the spread of heat from a fire into the adjacent compartments.

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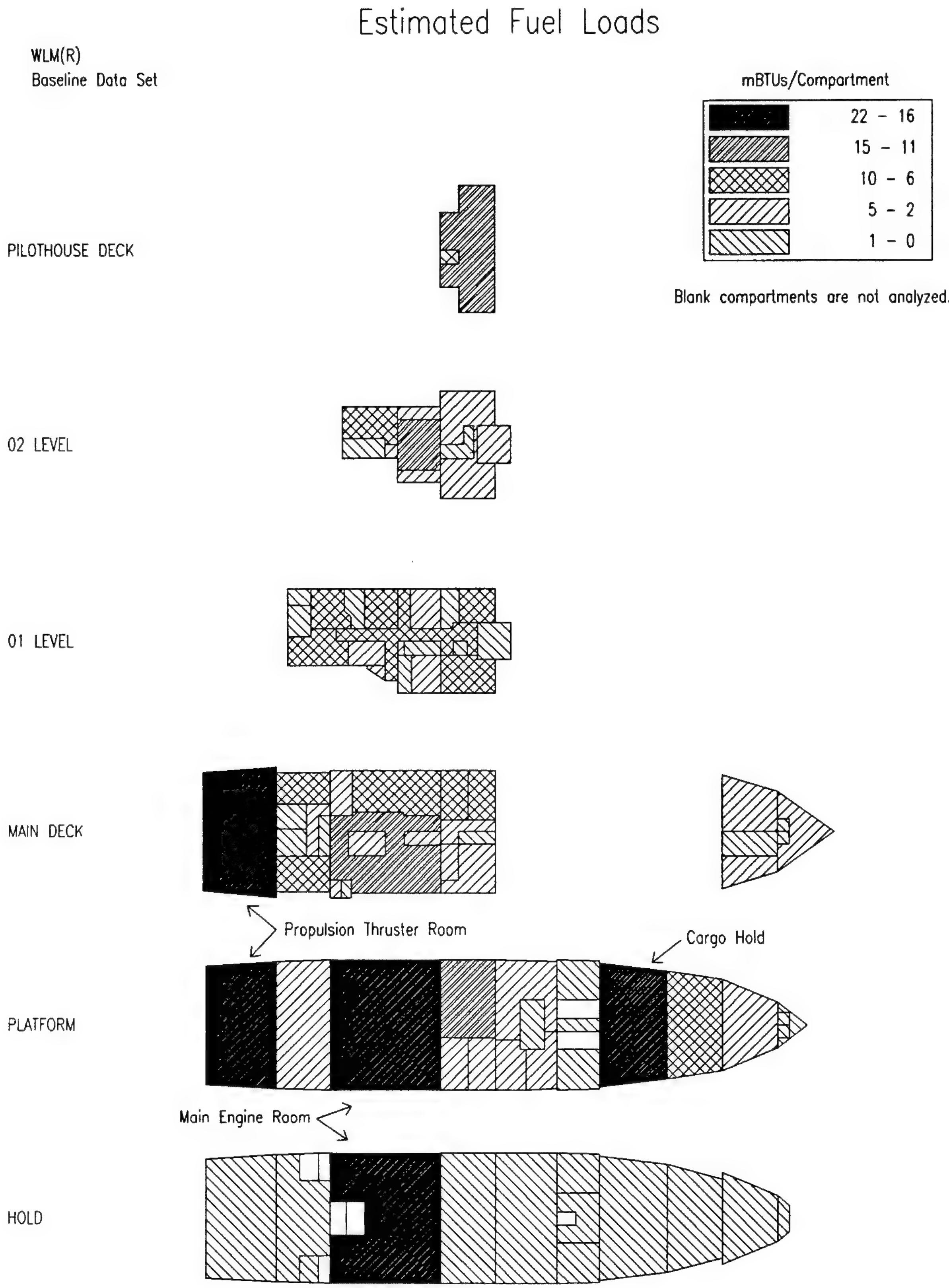

Figure 5.4 Estimated Fuel Loads in the WLM(R)

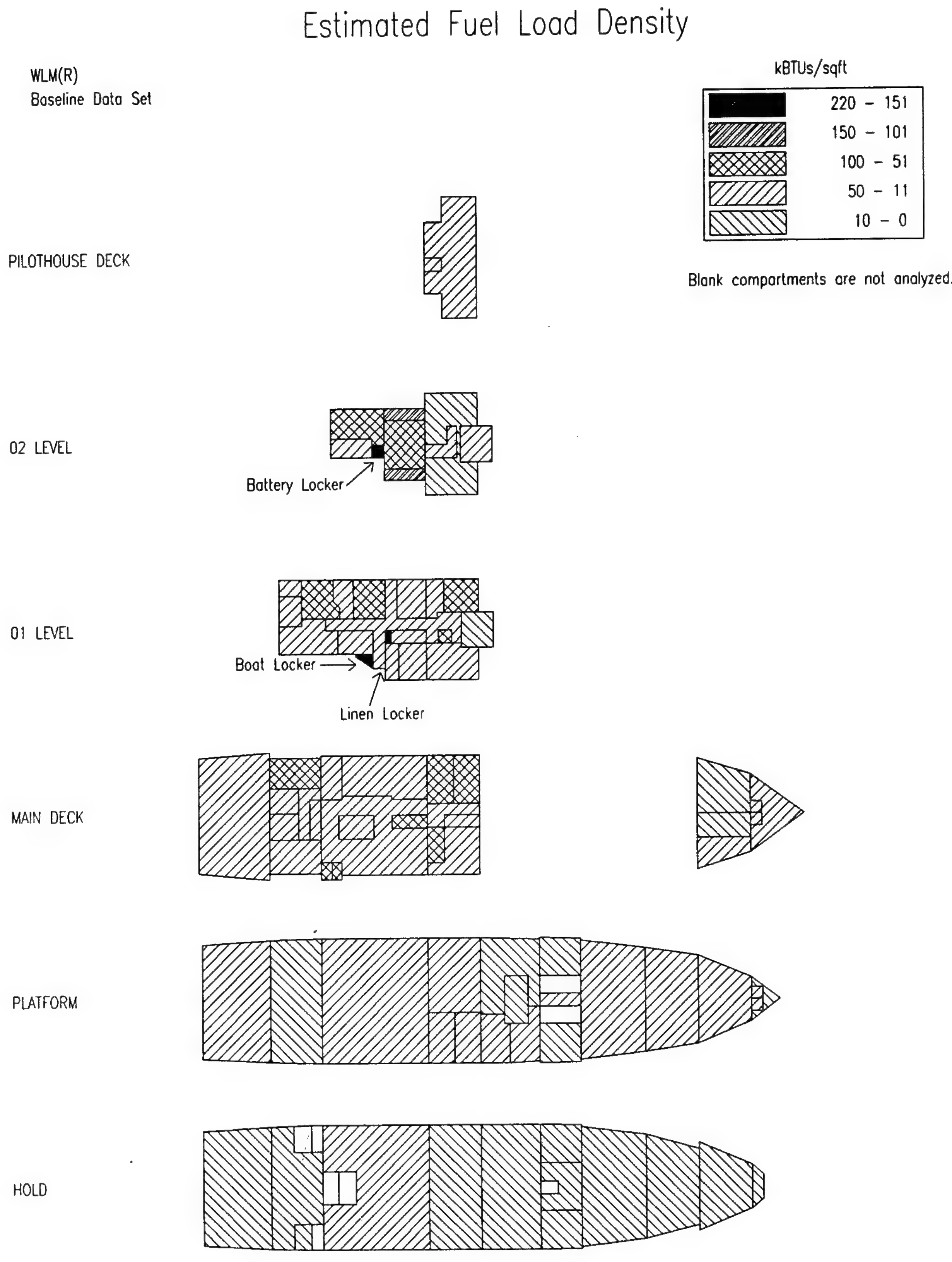

Figure 5.5 Estimated Fuel Load Densities in the WLM(R)

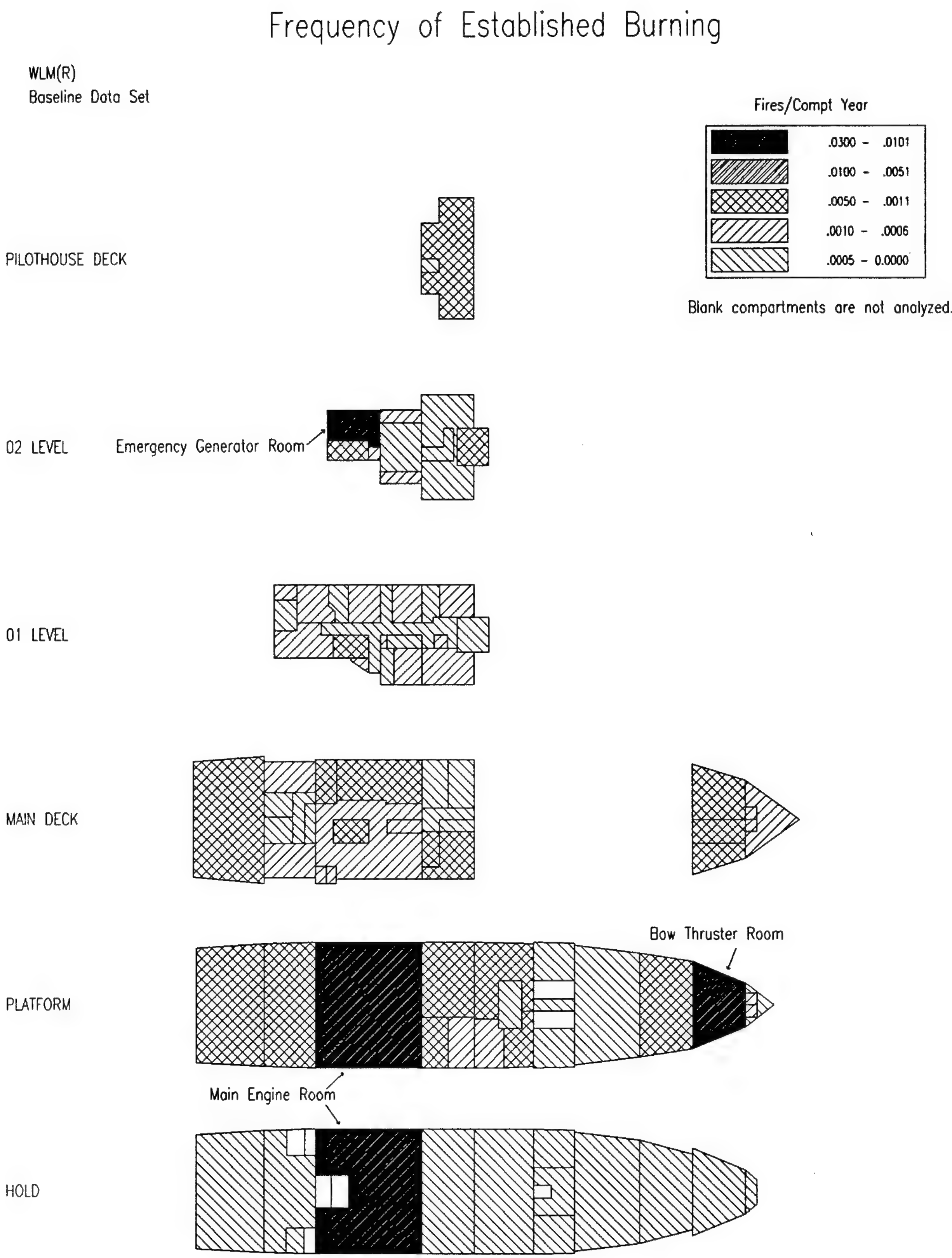

Figure 5.6 Frequency of EB in the WLM(R)

5.1.3. ANALYSIS OF ALTERNATIVES FOR THE WLM(R)

Nine alternatives were analyzed to gain insight into the relative effect of various fire protection features on the relatively high baseline fire safety levels of the WLM(R). The significant conclusions and associated recommendations from this study are discussed in section 3.3.3 and summarized in the following list:

- Reducing the fire detection system planned for this ship to that normally installed in other small cutters would not, by itself, result in unacceptable fire safety for this cutter compared to the FSOS. Nevertheless, considering the proposed minimal manning levels for this cutter, the planned fire detection system is considered a critically important fire safety design feature.
- Insulated barriers in the WLM(R) appear to be more beneficial than harmful, from a fire safety point of view. Comparing the results of reducing fire detection to the results of eliminating insulation in the barriers (see Tables D.2 through D.5), it also appears that eliminating insulation would have a greater adverse effect on fire safety than reducing the effectiveness of the fire detection system.
- Breaking windows in a fire would only slightly increase the fire damage this cutter may otherwise expect. This increase in expected fire damage by itself is not considered objectionable considering the FSOS.
- Due to the relatively high effectiveness of both the CO_2 flooding system and the AFFF sprinkling systems against a class Bravo fire threat in the Engine Room, there is justification for eliminating one of these two automated, fixed fire protection systems. It should be noted however that a total flooding CO_2 system is considered more effective than an automated AFFF bilge sprinkling system against a class Charlie fire. Therefore, there is justification to retain both automated systems to combat the class Bravo and class Charlie fires that may occur in the Engine Room.
- The fire safety of the cutter may be improved by increasing the thickness, and therefore the fire resistance of certain non-structural bulkheads. The improvements in fire safety however, are considered so slight that requiring a change in the construction of the ship is not warranted.
- The slight increase in fire safety of the Chart Room does not justify the expense of installing a redundant automated fire protection system in the Emergency Generator Room, especially considering that both compartments exceed FSOS by a substantial margin with the proposed design.
- Removing the redundant system from the Engine Room is more harmful to the overall fire safety of the cutter than adding a redundant system to the Emergency Generator Room is beneficial. Therefore, if the Coast Guard can afford the luxury of only one redundant automated fire protection system, it should be installed in the Engine Room.
- Over the life of this, or any other cutter, barriers tend to degrade from a fire safety point of view. Considering barrier degradation in isolation, there is no substantial decrease in fire safety of this cutter.

- The fire safety of the WLM(R) proposed design is so good that it actually takes a combination of adverse effects before there is a significant decrease in overall fire safety.

5.2. FIRE PROTECTION DOCTRINE

The second objective in this project is the development of a tailored fire protection doctrine for the U.S. Coast Guard Replacement Coastal Buoy Tender. The new doctrine, submitted in its entirety with this report as Appendix E, describes procedures and tactics for combating all classes of fire in all types of compartments. The doctrine is in consonance with official Coast Guard policy published in the Naval Engineering Manual (COMDTINST M9000.6B), [9] and other official publications such as the Naval Ships' Technical Manuals. In addition, it incorporates approved recommendations and comments from Coast Guard Headquarters received in response to the interim technical reports previously submitted in the SCFP.

This doctrine reflects various assumptions made by the engineer/analysts when detailed information concerning the design of this cutter was lacking. These assumptions are documented in Appendices B and C and elsewhere in this report. **Due to these assumptions and the dynamically changing nature of the preliminary design, it is imperative that this doctrine be updated, based on a thorough ship-check, after the cutter has been delivered and prior to using this doctrine for training or indoctrination of the new crew.** Due to incomplete information, certain portions of Part C of the new fire protection doctrine are necessarily incomplete. For example the nature and location of automatic shutdowns for the main diesel engines are unknown and need to be included in section II.B of Part C of the new doctrine.

5.3. SHIP FIRE SAFETY ENGINEERING METHODOLOGY

The technical approach in this project required the use of the SFSEM as an analytical tool to evaluate ship fire safety. The SCFP project provided an opportunity to thoroughly exercise the methodology in detailed analyses of existing Coast Guard Cutters. Prior to this project, the SFSEM had only been used once before to analyze a proposed design of a hypothetical cutter in the preliminary design stage of construction. The WLM(R) is classified as a small cutter, and is in the preliminary design phase of construction at Marinette Marine Shipyard, Marinette, WI. An objective was thus established to evaluate the utility of the SFSEM/SAFE to analyze a proposed cutter in the preliminary design phase of construction.

5.3.1. USE OF THE SFSEM

Extensive and comprehensive analyses of the nine classes of cutters previously studied in the SCFP have resulted in the formulation of conclusions concerning the use of the SFSEM for further ship fire safety analysis. The analysis of the WLM(R) has provided additional insight into the use of the SFSEM/SAFE. These analyses have served to identify some areas of the methodology which should be considered for improvement.

Accordingly, the following conclusions are provided concerning the utility of the SFSEM, and several areas of improvement are identified in the next section of this report:

- The SFSEM provides a singularly effective approach for comparing heretofore incomparable entities such as barriers, fire protection equipment, and firefighting tactics for effect on a cutter as a fire safety system.
- The SFSEM is particularly appropriate to determine relative fire protection levels on existing vessels where detailed data required to run SAFE can be obtained. Moreover, it is conceivable that different ship classes can be rank ordered for their relative fire protection levels and compared to each other in their relative ability to meet or exceed FSOs.
- The SFSEM is particularly useful to compare various hypothetical improvements to fire safety. This can be implemented by comparing alternatives to determine their ability to supplant manual firefighting capabilities or comparing alternatives in order to choose a cost effective solution. Great care needs to be taken when analyzing alternatives that all affected variables are changed in the SAFE input data set to reflect realistic conditions a given alternative would impose on the ship.
- The SFSEM is useful for analyzing a preliminary design but only if adequate detail is known concerning the potential ship's characteristics such as thermal and physical properties of the bulkheads and decks, fuel loads, compartmentation geometries, firefighting systems and equipment etc. Otherwise significant assumptions have to be made which could affect the value of the study. If significant assumptions are made, a ship visit should be made to the actual delivered cutter to verify and validate these assumptions. Depending on the results of this validation, the analysis using SAFE may need to be accomplished again.
- The SFSEM is not suitable for use by competitive design contractors. Because of the engineering judgment required in many input parameters, consistency of results dictate that a single, knowledgeable analyst should use this methodology to compare competing designs.
- The SFSEM is not useful at the present time for analyzing smoke movement, people movement or to analyze the effect on the ship's structure. These modules are either under development or planned for future implementation.
- The SFSEM is not suitable for use by inexperienced analysts. Variables assigned by engineering judgment require knowledge of shipboard naval engineering/damage control as well as the methodology itself.
- FRI is a critically important concept in the SFSEM. The Beyler/Deal algorithm was the method used in previous analyses of small cutters in the SCFP to calculate the elapsed time from EB to FRI (FRI Time). The Beyler/Peatross algorithm was developed as a result of full scale testing and accounts for the thermally thin barriers encountered on board ship. A comparison of results between the two algorithms is discussed in section 2.3.6. These results show that FRI times are generally less with the new algorithm, and are considered more accurate.

- Fuel loads for small cutters previously analyzed in the SCFP were estimated using engineering judgment. The process for estimating fuel loads in the WLM(R) was improved by incorporating the results of a literature search where some fuel loads on other naval ships were actually weighed. Spreadsheets for each compartment in the WLM(R) were developed to permit incorporation of these results in a consistent manner. Default values for fuel load densities were then generated for consideration in future analyses which improves the efficiency of the ship visit.

5.3.2. AREAS OF IMPROVEMENT

The value of the SFSEM could be enhanced if certain areas of improvement were pursued. These areas have been the subject of separate correspondence, some of these areas are repeated here to emphasize their importance:

- The issue of FSOS is critically important because the SFSEM is a performance based method and FSOS establish the standard to which performance is compared. A procedure for establishing FSOS using a FTA approach was developed and documented in section 2.2.1.2. Since time and funds did not permit the use of this procedure in the analysis of the WLM(R), it is recommended that this procedure be used in a future fire safety analysis.
- The catalog of barrier materials is presently limited in scope to a relatively few number of materials with an associated standard thickness. In the analysis of the WLM(R), certain barriers in the cutter were "derated" by a small percentage to model non-standard thicknesses of actual barriers. This technique permits more accurate modeling of a greater number of barriers. Notwithstanding, it is recommended that the existing catalog of barrier materials be further improved to account for the various combinations of barrier materials encountered on board ship.
- Tbar and Dbar curves were developed for the existing barriers in the catalog using a technique developed by Worcester Polytechnic Institute. It is recommended that this technique be documented in the Theoretical Basis of the SFSEM so that future users may generate additional Tbar and Dbar curves for new barriers in a consistent manner.
- The present fire growth models are used to calculate important entities such as maximum heat release rate values of the burning fuel and the fire growth rate. It is recommended that the existing models be validated and brought up to date.
- The need to integrate remaining modules to analyze smoke, people movement and ship's structure into the SFSEM is considered critically important. It is highly recommended that the smoke movement module be developed and integrated as soon as possible.

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Appendix A
COMPARTMENTATION

Table A.1 is a tabulation of compartments in the U.S. Coast Guard Coastal Buoy Tender Replacement (WLM (R)) categorized by compartment use indicator (CUI). Only compartments analyzed in SAFE in conjunction with the fire safety analysis are listed; therefore fuel tanks are not shown.

The inboard and outboard profile views of the WLM (R) are shown in Figure A.1. The plan views of all decks are shown in Figures A.2 and A.3. These views include the access fittings for each compartment such as doors, scuttles, hatches and operable windows. The compartmentation shown represents how the ship was modeled in AutoCAD for the fire safety analysis.

Table A.1 WLM(R) Compartments by Compartment Use Indicator (CUI)

Plan ID	Compartment Name
CUI=AA (Cargo Holds)	
2-24-0-AA	CARGO HOLD
CUI=AG (Gear Lockers)	
2-4-1-A	CHAIN LKR
2-4-2-A	CHAIN LKR
1-0-0-Q	BOATSWAIN STRM
1-61-1-Q	REPAIR LKR
1-76-1-A	CLEANING GEAR LOCKER
01-53-1-A	CLEANING GEAR LOCKER
01-67-1-A	LINEN LOCKER
01-70-1-Q	BOAT LKR
01-83-4-Q	TRASH LKR
02-61-1-Q	PFD LKR
02-61-2-Q	PFD LKR
02-68-1-Q	BATTERY LKR
CUI=AS (Storerooms)	
3-47-1-Q	ENGRS STRM
3-52-1-Q	ELEC/ELEX STRM
1-77-1-A	SODA LKR
CUI=C (Ship Control, Communication)	
3-52-0-C	ENGINEERING CONTROL CTR
01-50-0-C	BUOY DECK CONTROL ROOM
02-52-0-C	PILOTHOUSE
CUI=EM (Main Propulsion-Mechanical)	
3-6-0-E	BOW THRUSTER ROOM
3-61-0-E	MAIN ENGINE ROOM
CUI=K (Hazardous Material Storage)	
1-6-3-Q	PAINT LKR
CUI=L1 (Senior Officer's Cabin)	
01-52-1-L	CO CABIN
01-62-1-L	CO SR
CUI=L2 (Officer/CPO Quarters)	
01-52-2-L	CPO SR (1)
01-61-2-L	CPO SR (1)
CUI=L5 (Crews Berthing)	
1-79-1-L	ENLISTED SR (4)
1-79-2-L	ENLISTED SR (3+1)
01-68-2-L	PO SR (2+2)
01-76-0-L	ENLISTED SR (4)
01-76-2-L	ENLISTED SR (2+2)
CUI=LL (Wardroom/ Mess/ Lounge Area)	
1-61-0-L	MESS ROOM
CUI=LP (Passageway/Staircase/Vestibule)	
3-35-0-Q	PASSAGE
1-52-0-L	PASSAGE
1-52-1-L	COMPANIONWAY
1-79-0-L	COMPANIONWAY
1-79-01-L	PASSAGE
01-55-0-L	PASSAGE
01-61-1-L	COMPANIONWAY
02-58-1-L	LADDER

Table A.1 WLM(R) Compartments by Compartment Use Indicator (CUI)

Plan ID	Compartment Name
CUI=LW (Sanitary Spaces)	
1-83-0-L	ENLISTED WR,WC&SH
1-83-2-L	ENLISTED WR,WC&SH
01-58-2-L	CPO WR,WC
01-66-1-L	CO WR,WC SHR
01-74-2-L	ENLISTED WR,WC&SH
01-83-2-L	ENLISTED WR,WC&SH
CUI=QA (Aux Machinery Spaces)	
3-15-0-E	HYDRAULIC EQPT RM
3-42-1-Q	POTABLE WATER EQPT RM
3-79-0-Q	PUMP ROOM
3-88-0-E	PROPULSION THRUSTER RM
CUI=QE (Emergency Aux Generator Rm)	
02-68-2-E	EMERGENCY GEN RM
CUI=QF (Fan Room)	
02-52-0-V	VOID
CUI=QG (Galley/ Pantry/ Scullery)	
1-61-2-Q	GALLEY
1-76-2-Q	SCULLERY
CUI=QL (Laundry)	
1-52-3-Q	CHANGE RM
1-58-1-Q	LAUNDRY
CUI=QO (Office Spaces)	
1-52-2-Q	SHIP'S OFFICE
1-57-2-Q	ENG OFFICE AND DC CENTRAL
02-61-0-C	CHART ROOM
CUI=QS (Shops)	
3-42-0-Q	MACHINE SHOP
3-57-1-Q	ELEC SHOP
1-6-1-Q	SERVICE LKR
1-6-2-Q	ATON SHOP
CUI=TU (Stacks/ Engine Uptakes)	
1-70-1-Q	UPTAKE
02-70-0-Q	STACK
CUI=V (Voids/ Cofferdams)	
3-0-0-V	FOREPEAK
3-15-0-V	VOID
3-24-0-V	VOID
3-35-0-V	VOID
3-4-0-V	VOID
3-42-0-V	VOID
3-52-0-V	VOID
3-6-0-V	VOID
3-79-0-V	VOID
3-88-0-V	VOID
01-51-0-V	VOID
CUI=W (Water Tank)	
3-35-1-W	BALLAST TANK
3-35-2-W	BALLAST TANK
3-81-1-W	GRAY WTR HOLDING TNK
2-44-0-W	FRESH WATER TANK

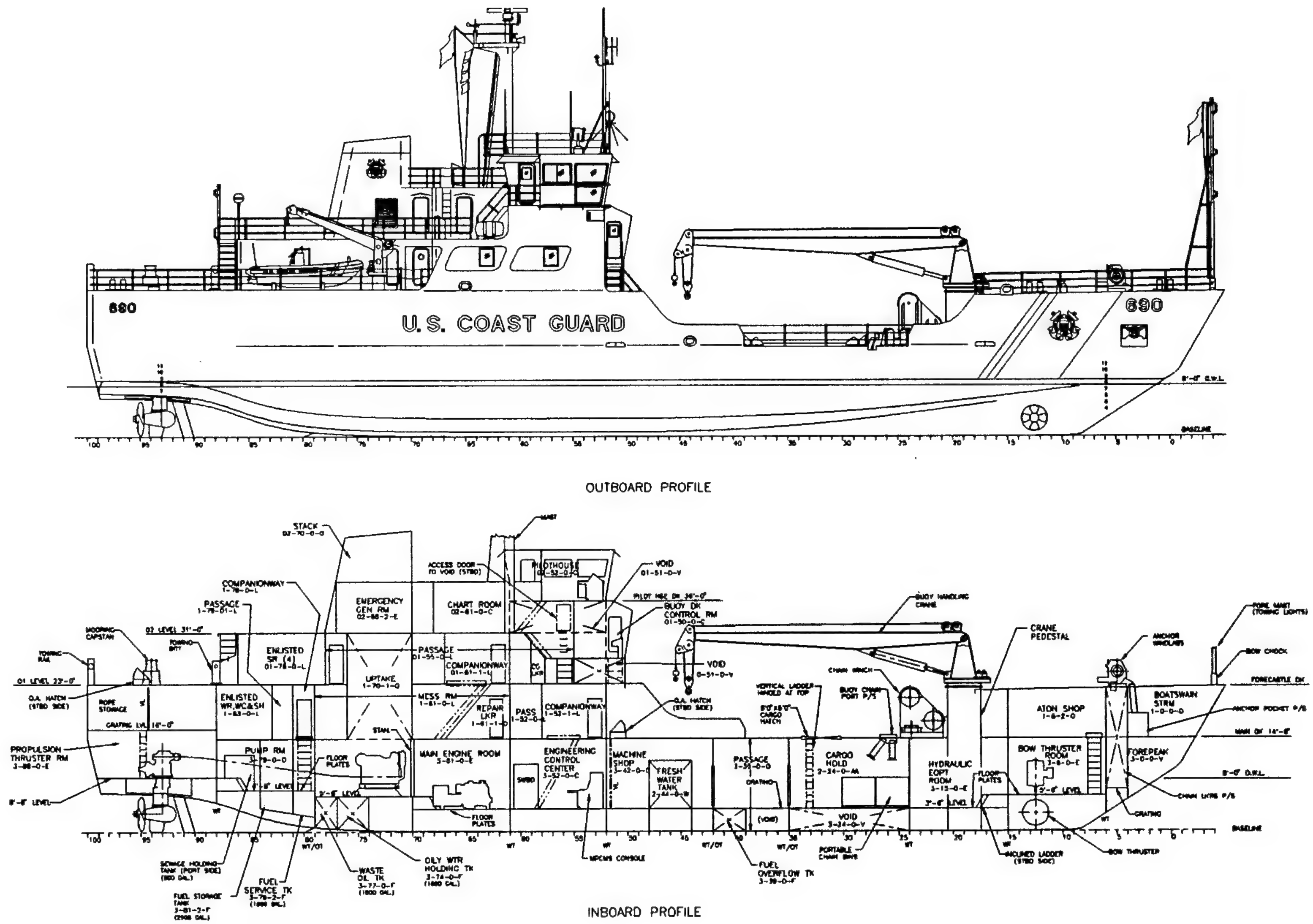

Figure A.1 WLM(R) Inboard and Outboard Profile

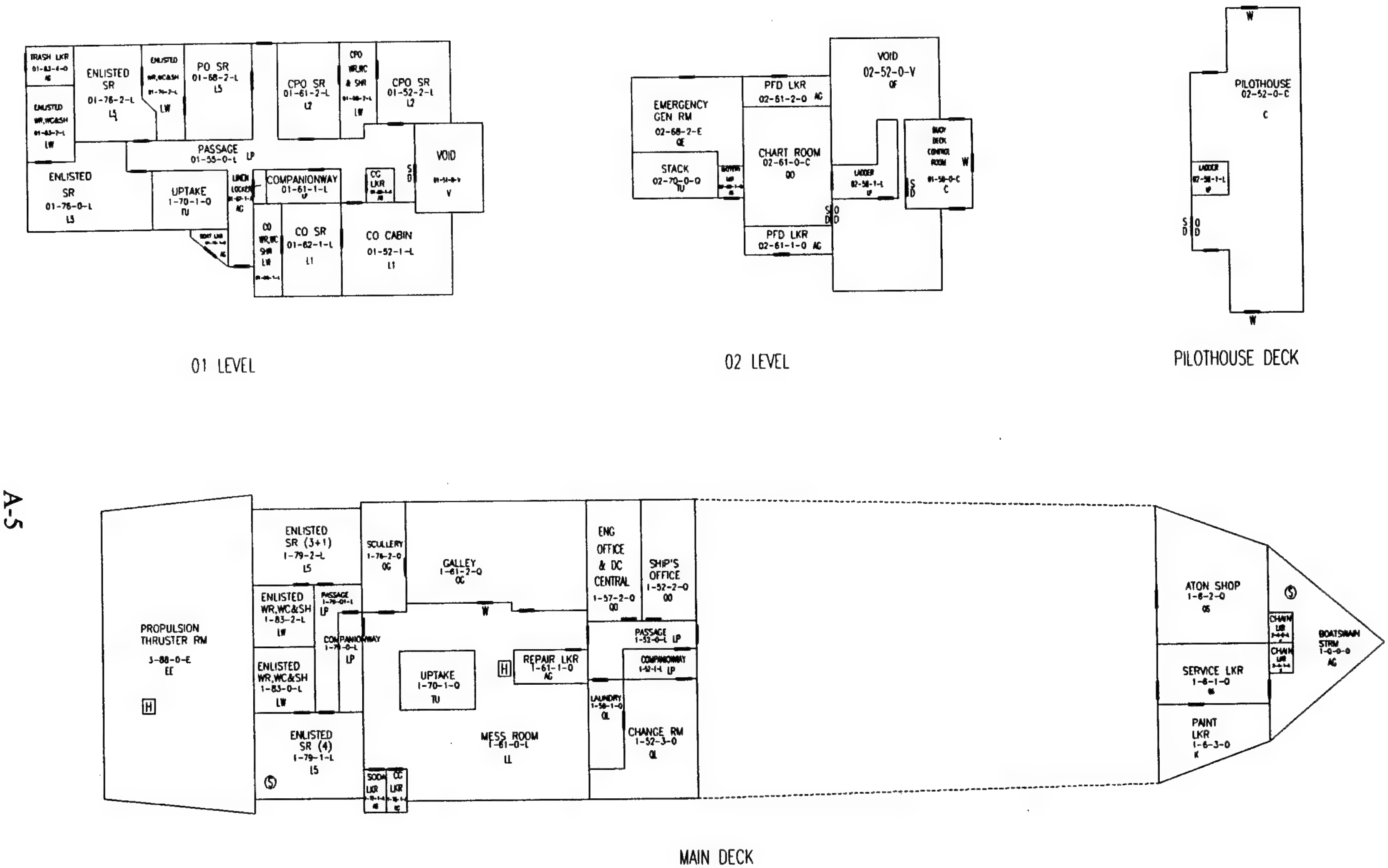

Figure A.2 WLM(R) Main Deck, 01 Level, 02 Level, and Pilothouse Deck

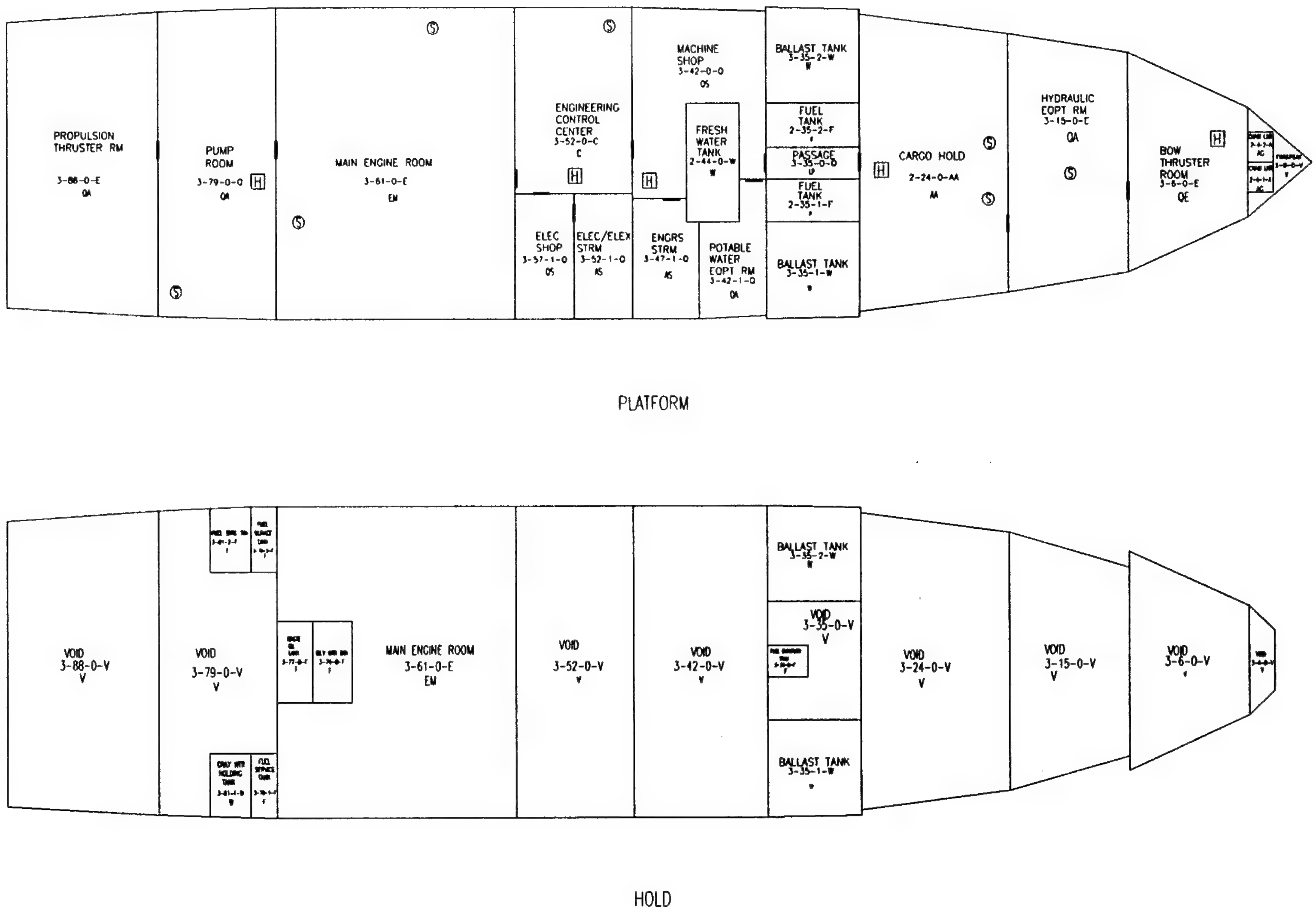

Figure A.3 WLM(R) Platform and Hold Deck

Appendix B
BASELINE INPUT DATA

The various input data required to perform a fire safety analysis on the U.S. Coast Guard Coastal Buoy Tender Replacement (WLM (R)) using SAFE is documented in Appendices B and C. In Appendix C the data is organized by compartment and barrier. In this Appendix the same input data is organized by category of information into eight major sections. At the beginning of each section the <u>sources</u> of the data are documented as well as the <u>assumptions</u> when complete information was not available.

The following is an index of the sections contained in this Appendix:

B.1 GEOMETRY

B.1.1 Compartment Height and Deck Area
B.1.2 Ventilation Openings: Area and Average Height

SOURCES

- The compartment height and deck area, as well as the location of doors and hatches, and the size of the hatches was determined from ships' drawings, References A and B.
- Damage Control ratings for doors and hatches were assigned in accordance with Table 079-9 of Reference C and Section II.A.2 of Reference F for guidance.
- Ventilation area and height was determined using engineering judgment and Chapter IV, Section C.3.3.3 of Reference D for guidance.

ASSUMPTIONS

- Two scuttles were assigned in the cargo deck to account for the two buoy chain ports identified on Reference A.
- Each joiner door was assumed to contain a louvered vent with an effective area of 216 sq. in. and a height of 19 in. This was based on measurements taken from joiner doors purchased by Marinette Marine Corporation for installation on the WLB(R). All joiner doors are assumed to have a 1 in. high by 30 in. wide clearance space at the sill.
- Doors ordered by Marinette Marine for weathertight applications such as those in the superstructure are more like watertight doors than joiner doors and have been assigned accordingly.
- Each heated / air conditioned compartment was considered to have one or two 4" by 12" supplies and returns depending on the size of the compartment.
- The hawse pipe opening in each chain locker was assumed to be a vent with an effective area of 25 sq. in. and an average height of 198 in..
- The Gaylord hood in the galley was assumed to have an effective area of 144 sq. in. and an average height of 72 in..
- All vents with horizontal openings were considered to have an average vent height equal to the compartment height regardless of their elevation in the compartment.

DATA

- Table B.1.1 contains compartment height and deck area information as well as cumulative ventilation opening area and average ventilation opening height.
- Table B.1.2 contains information concerning individual ventilation openings in each compartment.

Table B.1.1 Geometry (page 1 of 2)

Plan ID	Compartment Name	Height (Ft.)	Area (Sq.Ft)	Vent Area (Sq. In.)	Avg. Vent Height (In.)
CUI=AA	**(Cargo Holds)**				
2-24-0-AA	CARGO HOLD	11.0	577.8	172	132
CUI=AG	**(Gear Lockers)**				
2-4-1-A	CHAIN LKR	16.5	10.9	25	198
2-4-2-A	CHAIN LKR	16.5	10.9	25	198
1-0-0-Q	BOATSWAIN STRM	8.5	145.4	61	102
1-61-1-Q	REPAIR LKR	4.5	38.0	246	10
1-76-1-A	CLEANING GEAR LOCKER	8.5	13.4	246	10
01-53-1-A	CLEANING GEAR LOCKER	5.0	14.4	246	10
01-67-1-A	LINEN LOCKER	8.0	6.8	246	10
01-70-1-Q	BOAT LKR	8.0	12.5	36	96
01-83-4-Q	TRASH LKR	8.0	28.2	36	96
02-61-1-Q	PFD LKR	8.0	37.8	36	96
02-61-2-Q	PFD LKR	8.0	40.1	36	96
02-68-1-Q	BATTERY LKR	8.0	12.2	84	96
CUI=AS	**(Storerooms)**				
3-47-1-Q	ENGRS STRM	11.0	110.1	0	0
3-52-1-Q	ELEC/ELEX STRM	11.0	105.1	48	132
1-77-1-A	SODA LKR	8.5	14.4	246	10
CUI=C	**(Ship Control, Communication)**				
3-52-0-C	ENGINEERING CONTROL CTR	11.0	310.8	342	71
01-50-0-C	BUOY DECK CONTROL ROOM	9.0	90.0	294	43
02-52-0-C	PILOTHOUSE	8.0	416.2	192	4
CUI=EM	**(Main Propulsion-Mechanical)**				
3-6-0-E	BOW THRUSTER ROOM	9.0	279.0	61	108
3-61-0-E	MAIN ENGINE ROOM	14.5	1063.0	1496	174
CUI=K	**(Hazardous Material Storage)**				
1-6-3-Q	PAINT LKR	8.5	97.5	307	56
CUI=L1	**(Senior Officer's Cabin)**				
01-52-1-L	CO CABIN	8.0	148.2	417	53
01-62-1-L	CO SR	8.0	83.2	96	4
CUI=L2	**(Officer/CPO Quarters)**				
01-52-2-L	CPO SR (1)	8.0	90.2	588	8
01-61-2-L	CPO SR (1)	8.0	90.7	588	8
CUI=L5	**(Crews Berthing)**				
1-79-1-L	ENLISTED SR (4)	8.5	140.2	96	4
1-79-2-L	ENLISTED SR (3+1)	8.5	125.6	96	4
01-68-2-L	PO SR (2+2)	8.0	97.2	588	8
01-76-0-L	ENLISTED SR (4)	8.0	140.4	588	8
01-76-2-L	ENLISTED SR (2+2)	8.0	104.4	588	8
CUI=LL	**(Wardroom/ Mess/ Lounge Area)**				
1-61-0-L	MESS ROOM	8.5	529.4	1176	8
CUI=LP	**(Passageway/Staircase/Vestibule)**				
3-35-0-Q	PASSAGE	11.0	41.8	32	132
1-52-0-L	PASSAGE	8.5	63.7	834	9
1-52-1-L	COMPANIONWAY	8.5	34.0	246	10
1-79-0-L	COMPANIONWAY	8.5	35.8	0	0
1-79-01-L	PASSAGE	8.5	56.3	96	4
01-55-0-L	PASSAGE	8.0	239.1	3144	9
01-61-1-L	COMPANIONWAY	8.0	38.0	246	10
02-58-1-L	LADDER	8.0	48.2	0	0

Table B.1.1 Geometry (page 2 of 2)

Plan ID	Compartment Name	Height (Ft.)	Area (Sq.Ft)	Vent Area (Sq. In.)	Avg. Vent Height (In.)
CUI=LW	**(Sanitary Spaces)**				
1-83-0-L	ENLISTED WR,WC&SH	8.5	60.7	25	5
1-83-2-L	ENLISTED WR,WC&SH	8.5	57.4	25	5
01-58-2-L	CPO WR,WC	8.0	51.1	517	9
01-66-1-L	CO WR,WC SHR	8.0	39.5	25	5
01-74-2-L	ENLISTED WR,WC&SH	8.0	53.3	517	9
01-83-2-L	ENLISTED WR,WC&SH	8.0	55.0	271	8
CUI=QA	**(Aux Machinery Spaces)**				
3-15-0-E	HYDRAULIC EQPT RM	10.0	405.0	122	120
3-42-1-Q	POTABLE WATER EQPT RM	11.0	107.0	294	51
3-79-0-Q	PUMP ROOM	8.0	508.1	122	96
3-88-0-E	PROPULSION THRUSTER RM	14.5	682.0	172	174
CUI=QE	**(Emergency Aux Generator Rm)**				
02-68-2-E	EMERGENCY GEN RM	8.0	131.4	226	13
CUI=QF	**(Fan Room)**				
02-52-0-V	VOID	5.0	324.1	192	4
CUI=QG	**(Galley/ Pantry/ Scullery)**				
1-61-2-Q	GALLEY	8.5	286.1	486	20
1-76-2-Q	SCULLERY	8.5	74.4	96	4
CUI=QL	**(Laundry)**				
1-52-3-Q	CHANGE RM	8.5	150.3	540	9
1-58-1-Q	LAUNDRY	8.5	48.0	540	9
CUI=QO	**(Office Spaces)**				
1-52-2-Q	SHIP'S OFFICE	8.5	100.6	342	7
1-57-2-Q	ENG OFFICE AND DC CENTRAL	8.5	100.6	342	7
02-61-0-C	CHART ROOM	8.0	158.1	96	4
CUI=QS	**(Shops)**				
3-42-0-Q	MACHINE SHOP	11.0	280.8	307	71
3-57-1-Q	ELEC SHOP	11.0	105.1	307	71
1-6-1-Q	SERVICE LKR	8.5	102.0	307	56
1-6-2-Q	ATON SHOP	8.5	199.5	86	102
CUI=TU	**(Stacks/ Engine Uptakes)**				
1-70-1-Q	UPTAKE	16.5	66.0	0	0
02-70-0-Q	STACK	8.0	60.3	1296	48
CUI=V	**(Voids/ Cofferdams)**				
3-0-0-V	FOREPEAK	8.5	27.8	0	0
3-15-0-V	VOID	4.5	379.5	0	0
3-24-0-V	VOID	3.5	577.8	0	0
3-35-0-V	VOID	3.5	137.4	0	0
3-4-0-V	VOID	2.5	30.7	0	0
3-42-0-V	VOID	3.5	591.4	0	0
3-52-0-V	VOID	3.5	521.0	0	0
3-6-0-V	VOID	5.5	279.0	0	0
3-79-0-V	VOID	4.5	388.7	0	0
3-88-0-V	VOID	4.5	639.4	0	0
01-51-0-V	VOID	4.0	90.0	0	0
CUI=W	**(Water Tank)**				
3-35-1-W	BALLAST TANK	14.5	126.4	0	0
3-35-2-W	BALLAST TANK	14.5	124.1	0	0
3-81-1-W	GRAY WTR HOLDING TNK	4.5	36.3	0	0
2-44-0-W	FRESH WATER TANK	7.5	88.4	0	0

Table B.1.2 Vent Data (page 1 of 5)

Plan ID	Compartment Name	# Vents	H/V	Area	Height	Total Area (Sq. In.)	Avg. Height (In.)
CUI=AA	**(Cargo Holds)**						
2-24-0-AA	CARGO HOLD					172	132
	Supply Vent	2	H	36	132		
	Return Vent	2	H	50	132		
CUI=AG	**(Gear Lockers)**						
2-4-1-A	CHAIN LKR					25	198
	Hawse Pipe Opening	1	H	25	198		
2-4-2-A	CHAIN LKR					25	198
	Hawse Pipe Opening	1	H	25	198		
1-0-0-Q	BOATSWAIN STRM					61	102
	Supply Vent	1	H	25	102		
	Return Vent	1	H	36	102		
1-61-1-Q	REPAIR LKR					246	10
	Joiner Door, NC-Louver	1	V	216	19		
	Joiner Door, NC-Sill Space	1	V	30	1		
1-76-1-A	CLEANING GEAR LOCKER					246	10
	Joiner Door, NC-Louver	1	V	216	19		
	Joiner Door, NC-Sill Space	1	V	30	1		
01-53-1-A	CLEANING GEAR LOCKER					246	10
	Joiner Door, NC-Louver	1	V	216	19		
	Joiner Door, NC-Sill Space	1	V	30	1		
01-67-1-A	LINEN LOCKER					246	10
	Joiner Door, NC-Louver	1	V	216	19		
	Joiner Door, NC-Sill Space	1	V	30	1		
01-70-1-Q	BOAT LKR					36	96
	Supply Vent	1	H	36	96		
01-83-4-Q	TRASH LKR					36	96
	Supply Vent	1	H	36	96		
02-61-1-Q	PFD LKR					36	96
	Supply Vent	1	H	36	96		
02-61-2-Q	PFD LKR					36	96
	Supply Vent	1	H	36	96		
02-68-1-Q	BATTERY LKR					84	96
	Supply Vent	1	H	36	96		
	Return Vent	1	H	48	96		
CUI=AS	**(Storerooms)**						
3-47-1-Q	ENGRS STRM	None				0	0
3-52-1-Q	ELEC/ELEX STRM					48	132
	Supply Vent	1	H	48	132		
1-77-1-A	SODA LKR					246	10
	Joiner Door, NC-Louver	1	V	216	19		
	Joiner Door, NC-Sill Space	1	V	30	1		
CUI=C	**(Ship Control, Communication)**						
3-52-0-C	ENGINEERING CONTROL CTR					342	71
	Supply Vent	1	H	48	132		
	Return Vent	1	H	48	132		
	Joiner Door, NC-Louver	1	V	216	19		
	Joiner Door, NC-Sill Space	1	V	30	1		
01-50-0-C	BUOY DECK CONTROL ROOM					294	43
	Supply Vent	1	H	48	108		
	Joiner Door, NC-Louver	1	V	216	19		
	Joiner Door, NC-Sill Space	1	V	30	1		
02-52-0-C	PILOTHOUSE					192	4
	Supply Vent	2	V	48	4		
	Return Vent	2	V	48	4		

H/V = Horizontal or Vertical
Vent Height for Horizontal Vents=Compartment Height

Table B.1.2 Vent Data (page 2 of 5)

Plan ID	Compartment Name	# Vents	H/V	Area	Height	Total Area (Sq. In.)	Avg. Height (In.)
CUI=EM	**(Main Propulsion-Mechanical)**						
3-6-0-E	BOW THRUSTER ROOM					61	108
	Supply Vent	1	H	25	108		
	Return Vent	1	H	36	108		
3-61-0-E	MAIN ENGINE ROOM					1496	174
	Supply Vent	1	H	1296	174		
	Return Vent	2	H	100	174		
CUI=K	**(Hazardous Material Storage)**						
1-6-3-Q	PAINT LKR					307	56
	Supply Vent	1	H	25	102		
	Return Vent	1	H	36	102		
	Joiner Door, NC-Louver	1	V	216	19		
	Joiner Door, NC-Sill Space	1	V	30	1		
CUI=L1	**(Senior Officer's Cabin)**						
01-52-1-L	CO CABIN					417	53
	Supply Vent	1	H	80	96		
	Return Vent	1	H	91	96		
	Joiner Door, NC-Louver	1	V	216	19		
	Joiner Door, NC-Sill Space	1	V	30	1		
01-62-1-L	CO SR					96	4
	Supply Vent	1	V	48	4		
	Return Vent	1	V	48	4		
CUI=L2	**(Officer/CPO Quarters)**						
01-52-2-L	CPO SR (1)					588	8
	Supply Vent	1	V	48	4		
	Return Vent	1	V	48	4		
	Joiner Door, NC-Louver	2	V	216	19		
	Joiner Door, NC-Sill Space	2	V	30	1		
01-61-2-L	CPO SR (1)					588	8
	Supply Vent	1	V	48	4		
	Return Vent	1	V	48	4		
	Joiner Door, NC-Louver	2	V	216	19		
	Joiner Door, NC-Sill Space	2	V	30	1		
CUI=L5	**(Crews Berthing)**						
1-79-1-L	ENLISTED SR (4)					96	4
	Supply Vent	1	V	48	4		
	Return Vent	1	V	48	4		
1-79-2-L	ENLISTED SR (3+1)					96	4
	Supply Vent	1	V	48	4		
	Return Vent	1	V	48	4		
01-68-2-L	PO SR (2+2)					588	8
	Supply Vent	1	V	48	4		
	Return Vent	1	V	48	4		
	Joiner Door, NC-Louver	2	V	216	19		
	Joiner Door, NC-Sill Space	2	V	30	1		
01-76-0-L	ENLISTED SR (4)					588	8
	Supply Vent	1	V	48	4		
	Return Vent	1	V	48	4		
	Joiner Door, NC-Louver	2	V	216	19		
	Joiner Door, NC-Sill Space	2	V	30	1		
01-76-2-L	ENLISTED SR (2+2)					588	8
	Supply Vent	1	V	48	4		
	Return Vent	1	V	48	4		
	Joiner Door, NC-Louver	2	V	216	19		
	Joiner Door, NC-Sill Space	2	V	30	1		

H/V = Horizontal or Vertical
Vent Height for Horizontal Vents=Compartment Height

Table B.1.2 Vent Data (page 3 of 5)

Plan ID	Compartment Name	# Vents	H/V	Area	Height	Total Area (Sq. In.)	Avg. Height (In.)
CUI=LL	**(Wardroom/ Mess/ Lounge Area)**						
1-61-0-L	MESS ROOM					1176	8
	Supply Vent	2	V	48	4		
	Return Vent	2	V	48	4		
	Joiner Door, NC-Louver	4	V	216	19		
	Joiner Door, NC-Sill Space	4	V	30	1		
CUI=LP	**(Passageway/Staircase/Vestibule)**						
3-35-0-Q	PASSAGE					32	132
	Supply Vent	1	H	16	132		
	Return Vent	1	H	16	132		
1-52-0-L	PASSAGE					834	9
	Supply Vent	1	V	48	4		
	Return Vent	1	V	48	4		
	Joiner Door, NC-Louver	3	V	216	19		
	Joiner Door, NC-Sill Space	3	V	30	1		
1-52-1-L	COMPANIONWAY					246	10
	Joiner Door, NC-Louver	1	V	216	19		
	Joiner Door, NC-Sill Space	1	V	30	1		
1-79-0-L	COMPANIONWAY	None				0	0
1-79-01-L	PASSAGE					96	4
	Supply Vent	1	V	48	4		
	Return Vent	1	V	48	4		
01-55-0-L	PASSAGE					3144	9
	Supply Vent	2	V	48	4		
	Return Vent	2	V	48	4		
	Joiner Door, NC-Louver	12	V	216	19		
	Joiner Door, NC-Sill Space	12	V	30	1		
01-61-1-L	COMPANIONWAY					246	10
	Joiner Door, NC-Louver	1	V	216	19		
	Joiner Door, NC-Sill Space	1	V	30	1		
02-58-1-L	LADDER	None				0	0
CUI=LW	**(Sanitary Spaces)**						
1-83-0-L	ENLISTED WR,WC&SH					25	5
	Return Vent	1	V	25	5		
1-83-2-L	ENLISTED WR,WC&SH					25	5
	Return Vent	1	V	25	5		
01-58-2-L	CPO WR,WC					517	9
	Return Vent	1	V	25	5		
	Joiner Door, NC-Louver	2	V	216	19		
	Joiner Door, NC-Sill Space	2	V	30	1		
01-66-1-L	CO WR,WC SHR					25	5
	Return Vent	1	V	25	5		
01-74-2-L	ENLISTED WR,WC&SH					517	9
	Return Vent	1	V	25	5		
	Joiner Door, NC-Louver	2	V	216	19		
	Joiner Door, NC-Sill Space	2	V	30	1		
01-83-2-L	ENLISTED WR,WC&SH					271	8
	Return Vent	1	V	25	5		
	Joiner Door, NC-Louver	1	V	216	19		
	Joiner Door, NC-Sill Space	1	V	30	1		

H/V = Horizontal or Vertical
Vent Height for Horizontal Vents=Compartment Height

Table B.1.2 Vent Data (page 4 of 5)

Plan ID	Compartment Name	# Vents	H/V	Area	Height	Total Area (Sq. In.)	Avg. Height (In.)
CUI=QA	**(Aux Machinery Spaces)**						
3-15-0-E	HYDRAULIC EQPT RM					122	120
	Supply Vent	2	H	25	120		
	Return Vent	2	H	36	120		
3-42-1-Q	POTABLE WATER EQPT RM					294	51
	Supply Vent	1	V	48	132		
	Joiner Door, NC-Louver	1	V	216	19		
	Joiner Door, NC-Sill Space	1	V	30	1		
3-79-0-Q	PUMP ROOM					122	96
	Supply Vent	2	H	25	96		
	Return Vent	2	H	36	96		
3-88-0-E	PROPULSION THRUSTER RM					172	174
	Supply Vent	2	H	36	174		
	Return Vent	2	H	50	174		
CUI=QE	**(Emergency Aux Generator Rm)**						
02-68-2-E	EMERGENCY GEN RM					226	13
	Supply Vent	1	V	162	18		
	Return Vent	1	V	64	8		
CUI=QF	**(Fan Room)**						
02-52-0-V	VOID					192	4
	Supply Vent	2	V	48	4		
	Return Vent	2	V	48	4		
CUI=QG	**(Galley/ Pantry/ Scullery)**						
1-61-2-Q	GALLEY					486	20
	Supply Vent	1	V	48	4		
	Return Vent	1	V	48	4		
	Joiner Door, NC-Louver	1	V	216	19		
	Joiner Door, NC-Sill Space	1	V	30	1		
	Gaylord Hood	1	H	144	72		
1-76-2-Q	SCULLERY					96	4
	Supply Vent	1	V	48	4		
	Return Vent	1	V	48	4		
CUI=QL	**(Laundry)**						
1-52-3-Q	CHANGE RM					540	9
	Supply Vent	1	V	48	4		
	Return Vent	2	V	216	19		
	Joiner Door, NC-Louver	2	V	30	1		
1-58-1-Q	LAUNDRY					540	9
	Return Vent	1	V	48	4		
	Joiner Door, NC-Louver	2	V	216	19		
	Joiner Door, NC-Sill Space	2	V	30	1		
CUI=QO	**(Office Spaces)**						
1-52-2-Q	SHIP'S OFFICE					342	7
	Supply Vent	1	V	48	4		
	Return Vent	1	V	48	4		
	Joiner Door, NC-Louver	1	V	216	19		
	Joiner Door, NC-Sill Space	1	V	30	1		
1-57-2-Q	ENG OFFICE AND DC CENTRAL					342	7
	Supply Vent	1	V	48	4		
	Return Vent	1	V	48	4		
	Joiner Door, NC-Louver	1	V	216	19		
	Joiner Door, NC-Sill Space	1	V	30	1		
02-61-0-C	CHART ROOM					96	4
	Supply Vent	1	V	48	4		
	Return Vent	1	V	48	4		

H/V = Horizontal or Vertical
Vent Height for Horizontal Vents=Compartment Height

Table B.1.2 Vent Data (page 5 of 5)

Plan ID	Compartment Name	# Vents	H/V	Area	Height	Total Area (Sq. In.)	Avg. Height (In.)
CUI=QS	**(Shops)**						
3-42-0-Q	MACHINE SHOP					307	71
	Supply Vent	1	H	25	132		
	Return Vent	1	H	36	132		
	Joiner Door, NC-Louver	1	V	216	19		
	Joiner Door, NC-Sill Space	1	V	30	1		
3-57-1-Q	ELEC SHOP					307	71
	Supply Vent	1	H	25	132		
	Return Vent	1	H	36	132		
	Joiner Door, NC-Louver	1	V	216	19		
	Joiner Door, NC-Sill Space	1	V	30	1		
1-6-1-Q	SERVICE LKR					307	56
	Supply Vent	1	H	25	102		
	Return Vent	1	H	36	102		
	Joiner Door, NC-Louver	1	V	216	19		
	Joiner Door, NC-Sill Space	1	V	30	1		
1-6-2-Q	ATON SHOP					86	102
	Supply Vent	1	H	36	102		
	Return Vent	1	H	50	102		
CUI=TU	**(Stacks/ Engine Uptakes)**						
1-70-1-Q	UPTAKE	None				0	0
02-70-0-Q	STACK					1296	48
	Supply Vent	1	V	1296	48		
CUI=V	**(Voids/ Cofferdams)**						
3-0-0-V	FOREPEAK	None				0	0
3-15-0-V	VOID	None				0	0
3-24-0-V	VOID	None				0	0
3-35-0-V	VOID	None				0	0
3-4-0-V	VOID	None				0	0
3-42-0-V	VOID	None				0	0
3-52-0-V	VOID	None				0	0
3-6-0-V	VOID	None				0	0
3-79-0-V	VOID	None				0	0
3-88-0-V	VOID	None				0	0
01-51-0-V	VOID	None				0	0
CUI=W	**(Water Tank)**						
3-35-1-W	BALLAST TANK	None				0	0
3-35-2-W	BALLAST TANK	None				0	0
3-81-1-W	GRAY WTR HOLDING TNK	None				0	0
2-44-0-W	FRESH WATER TANK	None				0	0

H/V = Horizontal or Vertical
Vent Height for Horizontal Vents=Compartment Height

B.2 CONSTRUCTION MATERIALS

B.2.1 Hull, Bulkheads and Decks/Overheads
B.2.2 Insulation
B.2.3 T-Adjust and D-Adjust Values

SOURCES

- Hull, bulkhead and deck/overhead material were determined using Reference A and the table of Barrier Materials from Reference D included here as Attachment B.2.1.
- Insulation was assigned in accordance with Section 635 "Thermal and Acoustic Insulation of Compartments", Reference E.
- Because the ship is new construction, T-adjust and D-adjust default values of 0% were assigned in accordance with the guidance provided in Chapter IV, Section C.3.2 of Reference D.

ASSUMPTIONS

- Hull material is considered 3/8" thick plate. This ignores the increased thickness of the "ice belt" and the "buoy port" as indicated on Reference A. The interior surfaces of the hull were assigned an insulated bulkhead rating of the same (steel) thickness as the hull material so that SAFE could account for the insulation present.
- Deck material is considered 1/4" thick steel. This ignores the increased thickness of the main deck between frames 15 and 52 which is 3/8" thick to support buoy handling.
- Decks which may be covered with a poured surface and/or tiled, such as the galley, scullery and lavatories, were assigned a SAFE rating of D06 vs. D05 because D05 values listed in Attachment B.2.1 are not considered valid for this application.
- Section 635 of Reference E states in part that weather boundaries and boundaries between heated and non-heated and air conditioned and non-air conditioned compartments shall be insulated. Having no direction as to which side of interior bulkheads were to be insulated, insulation was arbitrarily assigned to one side or the other. SAFE calculations do not differentiate between which side of a bulkhead is insulated except for the insulations' contribution to a compartments' fuel load.
- T-adjust/D-adjust values were modified where B09 and B10 (3/8" or thicker) material was specified in lieu of joiner materials B05 and B06 (1/4" or thinner). Appropriate values were assigned to adjust the B09 and B10 Tbar and Dbar values back to the corresponding B05 and B06 values.

DATA

- Construction materials are shown in Appendix C in the Barrier Fire Safety summary sheets.

Attachment B.2.1 Barrier Materials

The table below describes the thermal and physical characteristics of the barrier materials available in the SAFE database. The compartment summary sheets in Appendix C refer to barrier materials by their material ID code as shown in this table.

Material ID	Description	Thickness (m)	Density (kg/m^3)	Specific Heat (J/kg)	Thermal Cond. (W/mDegK)	Heat (%)	tbar (kBTU /sq ft) x1	x2	x3	dbar x1	x2	x3
Bulkhead	Materials:											
B00	Zero Strength bulkhead	0.0001	0	0	9999.00	100	0	0	0	0	0	0
B01	Expanded metal "screening"	0.0001	0	0	9999.00	80	0	0	0	0	0	0
B02	Nomex honeycomb core -plastic laminate both sides	0.0174	48	1210	0.07	30	2	6	14	3	12	20
B03	Nomex honeycomb core -stainless steel both sides	0.0174	50	1210	0.08	25	8	20	30	55	80	105
B04	Nomex honeycomb core -plastic laminate & thermal insulation	0.0510	50	1210	0.04	30	2	8	10	9	18	22
B05	Steel Joiner	0.0064	7840	500	45.30	5	1	4	10	60	80	100
B06	Steel Joiner with thermal insulation	0.0510	7800	100	1.00	5	5	15	18	75	100	120
B07	Aluminum structural bulkhead (5086)	0.0060	2657	963	126.34	15	0	3	5	4	8	12
B08	Aluminum structural bulkhead w/ thermal insulation	0.0500	2600	200	5.00	5	3	6	10	3	6	10
B09	Structural steel	0.0104	7840	500	45.30	5	1	5	12	70	90	110
B10	Structural steel w/ thermal insulation	0.0510	7800	100	1.00	5	6	18	20	80	110	130
Overhead	/Deck Materials											
D00	Zero strength overhead/deck	0.0001	0	0	9999.00	100	0	0	0	0	0	0
D01	Aluminum grating overhead/deck	0.0001	0	0	9999.00	90	0	0	0	0	0	0
D02	Steel grating overhead/deck	0.0001	0	0	9999.00	90	0	0	0	0	0	0
D03	Aluminum overhead (5086)	0.0060	2657	963	126.34	25	0	2	4	4	6	10
D04	Steel overhead/deck	0.0127	7840	500	45.30	5	3	9	15	120	140	160
D05	Steel overhead/deck w/ poured floor or tile (1/4")	0.0191	7800	750	2.00	3	60	80	105	260	320	350
D06	Steel overhead/deck w/ thermal insulation	0.0510	7800	100	1.00	5	6	18	20	80	110	130
Hull	Materials:											
H01	Aluminum shell plating (1/4")	0.0060	2657	963	126.34	15	0	3	5	4	8	12
H02	Steel shell plating (1/4")	0.0060	7840	500	45.30	5	1	4	10	60	80	100
H03	Steel shell plating (3/8")	0.0090	7840	500	45.30	5	1	4	10	65	85	105
H04	Steel shell plating (1/2")	0.0130	7840	500	45.30	5	1	4	10	70	90	110
H05	Steel shell plating (5/8")	0.0160	7840	500	45.30	5	2	5	12	75	95	115

B.3 FIRE SAFETY OBJECTIVES

B.3.1 Magnitude of Acceptable Loss (MAL)
B.3.2 Frequency of Acceptable Loss (FAL)

SOURCES

- The components that comprise the Magnitude of Acceptable Loss (MAL) ratings were assigned using engineering judgment, and based on experience gained assigning these components to similar compartments on cutters analyzed previously.
- MAL and Frequency of Acceptable Loss Ratings (FAL) were calculated using the formulas described below.

ASSUMPTIONS

- None

DATA

- Table B.3.1 documents the baseline MAL ratings and FAL values assigned to/calculated for each compartment. The following formulas are used to calculate the ratings once the MAL components have been assigned using engineering judgment

MAL component abbreviations used in Table B.3.1 are:

LS = LIFE SAFETY
PP = PROPERTY PROTECTION
PM = PRIMARY MISSION
SM = SECONDARY MISSIONS

MAL ratings are assigned to each component for each compartment that correspond to the following defined points in the fire growth curve:

1. EB not acceptable
2. EB acceptable, FRI not acceptable
3. FRI acceptable, CBO not acceptable
4. CBO acceptable

The following formula is used to calculate the MAL rating for each compartment. Note the overall MAL rating assigned is the truncated integer value (the value without truncation is used to calculate the FAL rating):

$$MAL=0.1*LS+0.3*PP+0.4*PM+0.2*SM$$

The formula used to derive FAL from MAL is:

$$FAL=32.25-(1.766*MAL)-(0.214*MAL^2)-(0.222*MAL^3)$$

This formula was developed using regression analysis that defines the FAL/MAL curve shown in Section 2.2.1.1 of this report.

Table B.3.1 Fire Safety Objectives (page 1 of 2)

Plan ID	Compartment Name	MAL Components LS	PP	PM	SM	MAL Rating	FAL (Years)
CUI=AA	(Cargo Holds)						
2-24-0-AA	CARGO HOLD	4	4	3	4	3	13
CUI=AG	(Gear Lockers)						
2-4-1-A	CHAIN LKR	4	4	3	3	3	15
2-4-2-A	CHAIN LKR	4	4	3	3	3	15
1-0-0-Q	BOATSWAIN STRM	4	4	3	3	3	15
1-61-1-Q	REPAIR LKR	4	4	4	4	4	8
1-76-1-A	CLEANING GEAR LOCKER	4	4	4	4	4	8
01-53-1-A	CLEANING GEAR LOCKER	4	4	4	4	4	8
01-67-1-A	LINEN LOCKER	4	4	4	4	4	8
01-70-1-Q	BOAT LKR	2	4	3	3	3	17
01-83-4-Q	TRASH LKR	4	4	4	4	4	8
02-61-1-Q	PFD LKR	2	4	3	3	3	17
02-61-2-Q	PFD LKR	2	4	3	3	3	17
02-68-1-Q	BATTERY LKR	2	4	3	3	3	17
CUI=AS	(Storerooms)						
3-47-1-Q	ENGRS STRM	4	4	4	4	4	8
3-52-1-Q	ELEC/ELEX STRM	4	3	4	4	3	12
1-77-1-A	SODA LKR	4	4	4	4	4	8
CUI=C	(Ship Control, Communication)						
3-52-0-C	ENGINEERING CONTROL CTR	2	3	2	2	2	24
01-50-0-C	BUOY DECK CONTROL ROOM	2	3	2	4	2	22
02-52-0-C	PILOTHOUSE	2	2	2	2	2	26
CUI=EM	(Main Propulsion-Mechanical)						
3-6-0-E	BOW THRUSTER ROOM	3	2	2	3	2	24
3-61-0-E	MAIN ENGINE ROOM	3	2	2	2	2	26
CUI=K	(Hazardous Material Storage)						
1-6-3-Q	PAINT LKR	1	1	1	1	1	30
CUI=L1	(Senior Officer's Cabin)						
01-52-1-L	CO CABIN	3	4	4	4	3	9
01-62-1-L	CO SR	3	4	4	4	3	9
CUI=L2	(Officer/CPO Quarters)						
01-52-2-L	CPO SR (1)	3	4	4	4	3	9
01-61-2-L	CPO SR (1)	3	4	4	4	3	9
CUI=L5	(Crews Berthing)						
1-79-1-L	ENLISTED SR (4)	3	4	4	4	3	9
1-79-2-L	ENLISTED SR (3+1)	3	4	4	4	3	9
01-68-2-L	PO SR (2+2)	3	4	4	4	3	9
01-76-0-L	ENLISTED SR (4)	3	4	4	4	3	9
01-76-2-L	ENLISTED SR (2+2)	3	4	4	4	3	9
CUI=LL	(Wardroom/ Mess/ Lounge Area)						
1-61-0-L	MESS ROOM	3	4	2	2	2	22
CUI=LP	(Passageway/Staircase/Vestibule)						
3-35-0-Q	PASSAGE	3	4	3	3	3	16
1-52-0-L	PASSAGE	3	4	3	3	3	16
1-52-1-L	COMPANIONWAY	3	4	3	3	3	16
1-79-0-L	COMPANIONWAY	3	4	3	3	3	16
1-79-01-L	PASSAGE	3	4	3	3	3	16
01-55-0-L	PASSAGE	3	4	3	3	3	16
01-61-1-L	COMPANIONWAY	3	4	3	3	3	16
02-58-1-L	LADDER	3	4	3	3	3	16

Table B.3.1 Fire Safety Objectives (page 2 of 2)

Plan ID	Compartment Name	MAL Components LS	PP	PM	SM	MAL Rating	FAL (Years)
CUI=LW	(Sanitary Spaces)						
1-83-0-L	ENLISTED WR,WC&SH	4	4	4	4	4	8
1-83-2-L	ENLISTED WR,WC&SH	4	4	4	4	4	8
01-58-2-L	CPO WR,WC	4	4	4	4	4	8
01-66-1-L	CO WR,WC SHR	4	4	4	4	4	8
01-74-2-L	ENLISTED WR,WC&SH	4	4	4	4	4	8
01-83-2-L	ENLISTED WR,WC&SH	4	4	4	4	4	8
CUI=QA	(Aux Machinery Spaces)						
3-15-0-E	HYDRAULIC EQPT RM	3	2	2	4	2	23
3-42-1-Q	POTABLE WATER EQPT RM	3	3	4	4	3	13
3-79-0-Q	PUMP ROOM	3	3	3	3	3	19
3-88-0-E	PROPULSION THRUSTER RM	3	2	2	2	2	26
CUI=QE	(Emergency Aux Generator Rm)						
02-68-2-E	EMERGENCY GEN RM	3	2	3	3	2	22
CUI=QF	(Fan Room)						
02-52-0-V	VOID	3	3	3	3	3	19
CUI=QG	(Galley/ Pantry/ Scullery)						
1-61-2-Q	GALLEY	3	3	2	2	2	24
1-76-2-Q	SCULLERY	3	3	2	2	2	24
CUI=QL	(Laundry)						
1-52-3-Q	CHANGE RM	3	4	3	4	3	14
1-58-1-Q	LAUNDRY	3	4	3	3	3	16
CUI=QO	(Office Spaces)						
1-52-2-Q	SHIP'S OFFICE	3	4	3	3	3	16
1-57-2-Q	ENG OFFICE AND DC CENTRAL	3	4	3	3	3	16
02-61-0-C	CHART ROOM	3	2	2	2	2	26
CUI=QS	(Shops)						
3-42-0-Q	MACHINE SHOP	3	4	4	4	3	9
3-57-1-Q	ELEC SHOP	3	4	4	4	3	9
1-6-1-Q	SERVICE LKR	3	4	4	4	3	9
1-6-2-Q	ATON SHOP	3	4	2	4	3	18
CUI=TU	(Stacks/ Engine Uptakes)						
1-70-1-Q	UPTAKE	4	4	2	2	2	21
02-70-0-Q	STACK	4	4	2	2	2	21
CUI=V	(Voids/ Cofferdams)						
3-0-0-V	FOREPEAK	4	4	4	4	4	8
3-15-0-V	VOID	4	4	4	4	4	8
3-24-0-V	VOID	4	4	4	4	4	8
3-35-0-V	VOID	4	4	4	4	4	8
3-4-0-V	VOID	4	4	4	4	4	8
3-42-0-V	VOID	4	4	4	4	4	8
3-52-0-V	VOID	4	4	4	4	4	8
3-6-0-V	VOID	4	4	4	4	4	8
3-79-0-V	VOID	4	4	4	4	4	8
3-88-0-V	VOID	4	4	4	4	4	8
01-51-0-V	VOID	4	4	2	4	3	17
CUI=W	(Water Tank)						
3-35-1-W	BALLAST TANK	4	4	4	4	4	8
3-35-2-W	BALLAST TANK	4	4	4	4	4	8
3-81-1-W	GRAY WTR HOLDING TNK	4	4	4	4	4	8
2-44-0-W	FRESH WATER TANK	4	4	4	4	4	8

B.4 FIRE DETECTION

SOURCES

- Percent monitored values were assigned using section 436 of Reference E which delineates the requirements for various types of detection systems that are required. Subsection 1.5.3 states in part that there shall be at least one smoke detector (installed) in each compartment.
- The estimated time to detection was calculated by SAFE in accordance with Chapter V, Section C of Reference D, based on the assigned percent monitored values.

ASSUMPTIONS

- Automatic detection equipment will be installed in all compartments except voids, tanks and chain lockers. This essentially provides monitoring 100% of the time in compartments with detectors installed whether the ship is in port or at sea. To account for reliability of equipment, 95% was assigned in lieu of 100%.

DATA

- Table B.4.1 documents the baseline automatic detection systems installed as well as the percent time monitored both in port and at sea. It also lists the calculated estimated time to detection.

Table B.4.1 Fire Detection (page 1 of 2)

Plan ID	Compartment Name	Detection Systems	% Time at Sea	Monitored in Port	Est. Minutes at Sea	to Detect. in Port
CUI=AA	**(Cargo Holds)**					
2-24-0-AA	CARGO HOLD	2 Ioniz. Smoke	95	95	1	1
CUI=AG	**(Gear Lockers)**					
2-4-1-A	CHAIN LKR	None	0	0	16	16
2-4-2-A	CHAIN LKR	None	0	0	16	16
1-0-0-Q	BOATSWAIN STRM	1 Ioniz Smoke	95	95	1	1
1-61-1-Q	REPAIR LKR	1 Ioniz Smoke	95	95	1	1
1-76-1-A	CLEANING GEAR LOCKER	1 Ioniz Smoke	95	95	1	1
01-53-1-A	CLEANING GEAR LOCKER	1 Ioniz Smoke	95	95	1	1
01-67-1-A	LINEN LOCKER	1 Ioniz Smoke	95	95	1	1
01-70-1-Q	BOAT LKR	1 Ioniz Smoke	95	95	1	1
01-83-4-Q	TRASH LKR	1 Ioniz Smoke	95	95	1	1
02-61-1-Q	PFD LKR	1 Ioniz Smoke	95	95	1	1
02-61-2-Q	PFD LKR	1 Ioniz Smoke	95	95	1	1
02-68-1-Q	BATTERY LKR	1 Ioniz Smoke	95	95	1	1
CUI=AS	**(Storerooms)**					
3-47-1-Q	ENGRS STRM	1 Ioniz Smoke	95	95	1	1
3-52-1-Q	ELEC/ELEX STRM	1 Ioniz Smoke	95	95	1	1
1-77-1-A	SODA LKR	1 Ioniz Smoke	95	95	1	1
CUI=C	**(Ship Control, Communication)**					
3-52-0-C	ENGINEERING CONTROL CTR	1 Ioniz Smoke	99	95	1	1
01-50-0-C	BUOY DECK CONTROL ROOM	1 Ioniz Smoke	95	95	1	1
02-52-0-C	PILOTHOUSE	1 Ioniz Smoke	99	95	1	1
CUI=EM	**(Main Propulsion-Mechanical)**					
3-6-0-E	BOW THRUSTER ROOM	1 Ioniz Smoke	95	95	1	1
3-61-0-E	MAIN ENGINE ROOM	3 Ioniz Smoke/ 4 Flame	95	95	1	1
CUI=K	**(Hazardous Material Storage)**					
1-6-3-Q	PAINT LKR	1 Ioniz Smoke	95	95	1	1
CUI=L1	**(Senior Officer's Cabin)**					
01-52-1-L	CO CABIN	1 Ioniz Smoke	95	95	1	1
01-62-1-L	CO SR	1 Ioniz Smoke	95	95	1	1
CUI=L2	**(Officer/CPO Quarters)**					
01-52-2-L	CPO SR (1)	1 Ioniz Smoke	95	95	1	1
01-61-2-L	CPO SR (1)	1 Ioniz Smoke	95	95	1	1
CUI=L5	**(Crews Berthing)**					
1-79-1-L	ENLISTED SR (4)	1 Ioniz Smoke	95	95	1	1
1-79-2-L	ENLISTED SR (3+1)	1 Ioniz Smoke	95	95	1	1
01-68-2-L	PO SR (2+2)	1 Ioniz Smoke	95	95	1	1
01-76-0-L	ENLISTED SR (4)	1 Ioniz Smoke	95	95	1	1
01-76-2-L	ENLISTED SR (2+2)	1 Ioniz Smoke	95	95	1	1
CUI=LL	**(Wardroom/ Mess/ Lounge Area)**					
1-61-0-L	MESS ROOM	1 Ioniz Smoke	95	95	1	1
CUI=LP	**(Passageway/Staircase/Vestibule)**					
3-35-0-Q	PASSAGE	1 Ioniz Smoke	95	95	1	1
1-52-0-L	PASSAGE	1 Ioniz Smoke	95	95	1	1
1-52-1-L	COMPANIONWAY	1 Ioniz Smoke	95	95	1	1
1-79-0-L	COMPANIONWAY	1 Ioniz Smoke	95	95	1	1
1-79-01-L	PASSAGE	1 Ioniz Smoke	95	95	1	1
01-55-0-L	PASSAGE	2 Ioniz Smoke	95	95	1	1
01-61-1-L	COMPANIONWAY	1 Ioniz Smoke	95	95	1	1
02-58-1-L	LADDER	1 Ioniz Smoke	95	95	1	1

Table B.4.1 Fire Detection(page 2 of 2)

Plan ID	Compartment Name	Detection Systems	% Time Monitored at Sea	% Time Monitored in Port	Est. Minutes to Detect. at Sea	Est. Minutes to Detect. in Port
CUI=LW	(Sanitary Spaces)					
1-83-0-L	ENLISTED WR,WC&SH	1 Ioniz Smoke	95	95	1	1
1-83-2-L	ENLISTED WR,WC&SH	1 Ioniz Smoke	95	95	1	1
01-58-2-L	CPO WR,WC	1 Ioniz Smoke	95	95	1	1
01-66-1-L	CO WR,WC SHR	1 Ioniz Smoke	95	95	1	1
01-74-2-L	ENLISTED WR,WC&SH	1 Ioniz Smoke	95	95	1	1
01-83-2-L	ENLISTED WR,WC&SH	1 Ioniz Smoke	95	95	1	1
CUI=QA	(Aux Machinery Spaces)					
3-15-0-E	HYDRAULIC EQPT RM	1 Ioniz Smoke	95	95	1	1
3-42-1-Q	POTABLE WATER EQPT RM	1 Ioniz Smoke	95	95	1	1
3-79-0-Q	PUMP ROOM	2 Ioniz Smoke	95	95	1	1
3-88-0-E	PROPULSION THRUSTER RM	2 Ioniz Smoke	95	95	1	1
CUI=QE	(Emergency Aux Generator Rm)					
02-68-2-E	EMERGENCY GEN RM	1 Ioniz Smoke/ 2 Flame	95	95	1	1
CUI=QF	(Fan Room)					
02-52-0-V	VOID	1 Ioniz Smoke	95	95	1	1
CUI=QG	(Galley/ Pantry/ Scullery)					
1-61-2-Q	GALLEY	1 Ioniz Smoke	95	95	1	1
1-76-2-Q	SCULLERY	1 Ioniz Smoke	95	95	1	1
CUI=QL	(Laundry)					
1-52-3-Q	CHANGE RM	1 Ioniz Smoke	95	95	1	1
1-58-1-Q	LAUNDRY	1 Ioniz Smoke	95	95	1	1
CUI=QO	(Office Spaces)					
1-52-2-Q	SHIP'S OFFICE	1 Ioniz Smoke	95	95	1	1
1-57-2-Q	ENG OFFICE AND DC CENTRAL	1 Ioniz Smoke	95	95	1	1
02-61-0-C	CHART ROOM	1 Ioniz Smoke	95	95	1	1
CUI=QS	(Shops)					
3-42-0-Q	MACHINE SHOP	1 Ioniz Smoke	95	95	1	1
3-57-1-Q	ELEC SHOP	1 Ioniz Smoke	95	95	1	1
1-6-1-Q	SERVICE LKR	1 Ioniz Smoke	95	95	1	1
1-6-2-Q	ATON SHOP	1 Ioniz Smoke	95	95	1	1
CUI=TU	(Stacks/ Engine Uptakes)					
1-70-1-Q	UPTAKE	1 Ioniz Smoke	95	95	1	1
02-70-0-Q	STACK	1 Ioniz Smoke	95	95	1	1
CUI=V	(Voids/ Cofferdams)					
3-0-0-V	FOREPEAK	None	0	0	16	16
3-15-0-V	VOID	None	0	0	16	16
3-24-0-V	VOID	None	0	0	16	16
3-35-0-V	VOID	None	0	0	16	16
3-4-0-V	VOID	None	0	0	16	16
3-42-0-V	VOID	None	0	0	16	16
3-52-0-V	VOID	None	0	0	16	16
3-6-0-V	VOID	None	0	0	16	16
3-79-0-V	VOID	None	0	0	16	16
3-88-0-V	VOID	None	0	0	16	16
01-51-0-V	VOID	None	95	95	1	1
CUI=W	(Water Tank)					
3-35-1-W	BALLAST TANK	None	0	0	16	16
3-35-2-W	BALLAST TANK	None	0	0	16	16
3-81-1-W	GRAY WTR HOLDING TNK	None	0	0	16	16
2-44-0-W	FRESH WATER TANK	None	0	0	16	16

B.5 AUTOMATED AND MANUAL SUPPRESSION

B.5.1 Installed Automated Fire Protection Systems
B.5.2 Manual Fire Extinguishing Equipment Available

SOURCES

- Section 555 of Reference E delineates the general requirements for fixed and manual firefighting equipment.
- Subsections 555-3, 555-4 and 555-6 of Reference E identify specific requirements for AFFF, CO_2 and Aqueous K_2CO_3 systems respectively.
- Additional information concerning the location of these systems was obtained from the PRO at Marinette Marine as documented in Reference H.
- Subsection 555-2 of Reference E identifies specific requirements for portable PKP and CO_2 extinguishers and subsection 555-5 of Reference E identifies requirements for portable AFFF equipment.
- Requirements for the firemain system were obtained from Drawing No. 175-WLM-521-001 Rev. -, Reference I. Note 30 on this drawing specifies the hose lengths required for fire stations.
- Note 35 on Reference I addresses requirements for AFFF re-entry hose stations.

ASSUMPTIONS

- All compartments requiring portable extinguishers will have the correct number and type installed in, or located within 30' of the compartment.
- All compartments will be serviced by a minimum of two firemain stations equipped with adequate lengths of hose.
- Although not a specification requirement, all compartments will also have two AFFF hoses available to them due to the number of AFFF re-entry stations installed, their location on the damage control deck, and hose length requirements vs. the ship's length.

DATA

- Table B.5.1 documents the location, type and number of installed automated fire protection systems and manual fire extinguishing equipment available to each compartment.

Table B.5.1 Automated and Manual Fire Protection Systems (page 1 of 2)

Plan ID	Compartment Name	Fixed Systems (Installed)	Manual Firefighting Portable Extinguishers	Equipment Hose/ 3 % AFFF	(Available) Fire Main
CUI=AA	**(Cargo Holds)**				
2-24-0-AA	CARGO HOLD	None	1 CO2/1 PKP	2	2
CUI=AG	**(Gear Lockers)**				
2-4-1-A	CHAIN LKR	None	1 PKP	2	2
2-4-2-A	CHAIN LKR	None	1 PKP	2	2
1-0-0-Q	BOATSWAIN STRM	None	1 PKP	2	2
1-61-1-Q	REPAIR LKR	None	2 PKP	2	2
1-76-1-A	CLEANING GEAR LOCKER	None	2 PKP	2	2
01-53-1-A	CLEANING GEAR LOCKER	None	1 CO2/2 PKP	2	2
01-67-1-A	LINEN LOCKER	None	1 PKP	2	2
01-70-1-Q	BOAT LKR	None	2 PKP	2	2
01-83-4-Q	TRASH LKR	None	1 PKP	2	2
02-61-1-Q	PFD LKR	None	2 CO2	2	2
02-61-2-Q	PFD LKR	None	2 CO2/2 PKP	2	2
02-68-1-Q	BATTERY LKR	None	1 CO2	2	2
CUI=AS	**(Storerooms)**				
3-47-1-Q	ENGRS STRM	None	1 CO2/1 PKP	2	2
3-52-1-Q	ELEC/ELEX STRM	None	1 CO2/1 PKP	2	2
1-77-1-A	SODA LKR	None	2 PKP	2	2
CUI=C	**(Ship Control, Communication)**				
3-52-0-C	ENGINEERING CONTROL CTR	None	1 CO2/1 PKP	2	2
01-50-0-C	BUOY DECK CONTROL ROOM	None	1 CO2/2 PKP	2	2
02-52-0-C	PILOTHOUSE	None	1 CO2/1 PKP	2	2
CUI=EM	**(Main Propulsion-Mechanical)**				
3-6-0-E	BOW THRUSTER ROOM	6% AFFF	1 CO2	2	2
3-61-0-E	MAIN ENGINE ROOM	6% AFFF/CO2	2 CO2/2 PKP	3	3
CUI=K	**(Hazardous Material Storage)**				
1-6-3-Q	PAINT LKR	CO2	1 CO2/2 PKP	2	2
CUI=L1	**(Senior Officer's Cabin)**				
01-52-1-L	CO CABIN	None	3 PKP	2	2
01-62-1-L	CO SR	None	3 PKP	2	2
CUI=L2	**(Officer/CPO Quarters)**				
01-52-2-L	CPO SR (1)	None	3 PKP	2	2
01-61-2-L	CPO SR (1)	None	3 PKP	2	2
CUI=L5	**(Crews Berthing)**				
1-79-1-L	ENLISTED SR (4)	None	2 PKP	2	2
1-79-2-L	ENLISTED SR (3+1)	None	2 PKP	2	2
01-68-2-L	PO SR (2+2)	None	3 PKP	2	2
01-76-0-L	ENLISTED SR (4)	None	3 PKP	2	2
01-76-2-L	ENLISTED SR (2+2)	None	3 PKP	2	2
CUI=LL	**(Wardroom/ Mess/ Lounge Area)**				
1-61-0-L	MESS ROOM	None	2 PKP	2	2
CUI=LP	**(Passageway/Staircase/Vestibule)**				
3-35-0-Q	PASSAGE	None	1 PKP	2	2
1-52-0-L	PASSAGE	None	1 PKP	2	2
1-52-1-L	COMPANIONWAY	None	4 PKP	2	2
1-79-0-L	COMPANIONWAY	None	1 CO2/2 PKP	2	2
1-79-01-L	PASSAGE	None	2 PKP	2	2
01-55-0-L	PASSAGE	None	2 PKP	2	2
01-61-1-L	COMPANIONWAY	None	2 PKP	2	2
02-58-1-L	LADDER	None	1 CO2/1 PKP	2	2

Table B.5.1 Automated and Manual Fire Protection Systems (page 2 of 2)

Plan ID	Compartment Name	Fixed Systems (Installed)	Manual Firefighting Portable Extinguishers	Equipment Hose/ 3 % AFFF	(Available) Fire Main
CUI=LW	**(Sanitary Spaces)**				
1-83-0-L	ENLISTED WR,WC&SH	None	1 PKP	2	2
1-83-2-L	ENLISTED WR,WC&SH	None	1 PKP	2	2
01-58-2-L	CPO WR,WC	None	2 PKP	2	2
01-66-1-L	CO WR,WC SHR	None	1 PKP	2	2
01-74-2-L	ENLISTED WR,WC&SH	None	2 PKP	2	2
01-83-2-L	ENLISTED WR,WC&SH	None	1 PKP	2	2
CUI=QA	**(Aux Machinery Spaces)**				
3-15-0-E	HYDRAULIC EQPT RM	None	1 CO2/2 PKP	3	2
3-42-1-Q	POTABLE WATER EQPT RM	None	1 CO2/1 PKP	2	2
3-79-0-Q	PUMP ROOM	6% AFFF	1 CO2/2 PKP	3	2
3-88-0-E	PROPULSION THRUSTER RM	6% AFFF	1 CO2	2	2
CUI=QE	**(Emergency Aux Generator Rm)**				
02-68-2-E	EMERGENCY GEN RM	CO2	1 CO2/2 PKP	2	2
CUI=QF	**(Fan Room)**				
02-52-0-V	VOID	None	1 PKP	2	2
CUI=QG	**(Galley/ Pantry/ Scullery)**				
1-61-2-Q	GALLEY	K2CO3	2 PKP	2	2
1-76-2-Q	SCULLERY	None	2 PKP	2	2
CUI=QL	**(Laundry)**				
1-52-3-Q	CHANGE RM	None	1 PKP	2	2
1-58-1-Q	LAUNDRY	None	1 PKP	2	2
CUI=QO	**(Office Spaces)**				
1-52-2-Q	SHIP'S OFFICE	None	1 PKP	2	2
1-57-2-Q	ENG OFFICE AND DC CENTRAL	None	1 PKP	2	2
02-61-0-C	CHART ROOM	None	1 CO2/1 PKP	2	2
CUI=QS	**(Shops)**				
3-42-0-Q	MACHINE SHOP	None	1 CO2/1 PKP	2	2
3-57-1-Q	ELEC SHOP	None	1 CO2/1 PKP	2	2
1-6-1-Q	SERVICE LKR	None	1 CO2/2 PKP	2	2
1-6-2-Q	ATON SHOP	None	1 CO2/2 PKP	2	2
CUI=TU	**(Stacks/ Engine Uptakes)**				
1-70-1-Q	UPTAKE	None	2 CO2/2/PKP	2	2
02-70-0-Q	STACK	None	None	None	None
CUI=V	**(Voids/ Cofferdams)**				
3-0-0-V	FOREPEAK	None	None	None	None
3-15-0-V	VOID	None	None	None	None
3-24-0-V	VOID	None	None	None	None
3-35-0-V	VOID	None	None	None	None
3-4-0-V	VOID	None	None	None	None
3-42-0-V	VOID	None	None	None	None
3-52-0-V	VOID	None	None	None	None
3-6-0-V	VOID	None	None	None	None
3-79-0-V	VOID	None	None	None	None
3-88-0-V	VOID	None	None	None	None
01-51-0-V	VOID	None	None	None	None
CUI=W	**(Water Tank)**				
3-35-1-W	BALLAST TANK	None	None	None	None
3-35-2-W	BALLAST TANK	None	None	None	None
3-81-1-W	GRAY WTR HOLDING TNK	None	None	None	None
2-44-0-W	FRESH WATER TANK	None	None	None	None

B.6 PROBABILITY OF FLAME TERMINATION

B.6.1 Probability of Flame Termination by Self-Termination (I)
B.6.2 Probability of Flame Termination by Automated Fire Extinguishing Systems (A)
B.6.3 Probability of Flame Termination by Manual Firefighting Efforts (M)
B.6.4 Frequency of Established Burning (EB)

SOURCES

- I, A and M values given EB were assigned by engineering judgment and based on corresponding values assigned on cutters analyzed earlier, References G and J.
- I, A and M values given Tbar and given Dbar were calculated using formulas documented in Appendix J of Reference D.
- Frequency of Established Burning (EB) values were obtained from Section 3.1.1 of this report.

ASSUMPTIONS

- A probability of 10% for I given EB for the Propulsion Thruster Room was assigned because of the large quantity of towline stowed in this space.

DATA

- Table B.6.1 documents the probabilities of flame termination values assigned/calculated for each compartment for both active and passive suppression.

Table B.6.1 Probability of Flame Termination (page 1 of 2)

Plan ID	Compartment Name	I Values EB	I Values TBAR	I Values DBAR	A Values EB	A Values TBAR	A Values DBAR	M Values EB	M Values TBAR	M Values DBAR
CUI=AA	**(Cargo Holds) Frequency of EB=0.0001**									
2-24-0-AA	CARGO HOLD	10	13	8	0	0	0	10	18	8
CUI=AG	**(Gear Lockers) Frequency of EB=0.0010**									
2-4-1-A	CHAIN LKR	99	99	99	0	0	0	99	99	60
2-4-2-A	CHAIN LKR	99	99	99	0	0	0	99	99	60
1-0-0-Q	BOATSWAIN STRM	10	13	6	0	0	0	20	24	12
1-61-1-Q	REPAIR LKR	10	13	6	0	0	0	20	24	12
1-76-1-A	CLEANING GEAR LOCKER	40	44	24	0	0	0	30	60	30
01-53-1-A	CLEANING GEAR LOCKER	10	13	6	0	0	0	20	24	12
01-67-1-A	LINEN LOCKER	10	13	6	0	0	0	20	24	12
01-70-1-Q	BOAT LKR	10	13	6	0	0	0	20	24	12
01-83-4-Q	TRASH LKR	10	13	6	0	0	0	20	24	12
02-61-1-Q	PFD LKR	0	0	0	0	0	0	10	12	6
02-61-2-Q	PFD LKR	0	0	0	0	0	0	10	12	6
02-68-1-Q	BATTERY LKR	10	13	6	0	0	0	20	24	12
CUI=AS	**(Storerooms) Frequency of EB=0.0009**									
3-47-1-Q	ENGRS STRM	40	44	24	0	0	0	30	60	30
3-52-1-Q	ELEC/ELEX STRM	40	44	24	0	0	0	30	60	30
1-77-1-A	SODA LKR	40	44	24	0	0	0	30	60	30
CUI=C	**(Ship Control, Comm.) Frequency of EB=0.0012**									
3-52-0-C	ENGINEERING CONTROL CTR	50	55	30	0	0	0	40	44	24
01-50-0-C	BUOY DECK CONTROL ROOM	70	77	42	0	0	0	40	44	24
02-52-0-C	PILOTHOUSE	50	55	30	0	0	0	40	44	24
CUI=EM	**(Main Propulsion-Mechanical) Frequency of EB=0.0272**									
3-6-0-E	BOW THRUSTER ROOM	70	77	42	25	28	23	40	50	24
3-61-0-E	MAIN ENGINE ROOM	40	48	44	90	99	99	20	24	22
CUI=K	**(Hazardous Material Storage) Frequency of EB=0.0013**									
1-6-3-Q	PAINT LKR	10	25	10	45	50	40	10	15	5
CUI=L1	**(Senior Officer's Cabin) Frequency of EB=0.0008**									
01-52-1-L	CO CABIN	20	24	10	0	0	0	30	39	18
01-62-1-L	CO SR	20	24	10	0	0	0	30	39	18
CUI=L2	**(Officer/CPO Quarters) Frequency of EB=0.0008**									
01-52-2-L	CPO SR (1)	40	44	24	0	0	0	30	48	21
01-61-2-L	CPO SR (1)	40	44	24	0	0	0	30	48	21
CUI=L5	**(Crews Berthing) Frequency of EB=0.0008**									
1-79-1-L	ENLISTED SR (4)	50	50	30	0	0	0	20	40	18
1-79-2-L	ENLISTED SR (3+1)	50	50	30	0	0	0	20	40	18
01-68-2-L	PO SR (2+2)	50	50	30	0	0	0	20	40	18
01-76-0-L	ENLISTED SR (4)	50	50	30	0	0	0	20	40	18
01-76-2-L	ENLISTED SR (2+2)	50	50	30	0	0	0	20	40	18
CUI=LL	**(Wardroom/ Mess/ Lounge Area) Frequency of EB=0.0008**									
1-61-0-L	MESS ROOM	30	33	18	0	0	0	40	50	24
CUI=LP	**(Passageway/Staircase/Vestibule) Frequency of EB=0.0001**									
3-35-0-Q	PASSAGE	99	99	90	0	0	0	80	88	72
1-52-0-L	PASSAGE	99	99	90	0	0	0	80	88	72
1-52-1-L	COMPANIONWAY	99	99	90	0	0	0	80	88	72
1-79-0-L	COMPANIONWAY	99	99	90	0	0	0	80	88	72
1-79-01-L	PASSAGE	99	99	90	0	0	0	80	88	72
01-55-0-L	PASSAGE	99	99	90	0	0	0	80	88	72
01-61-1-L	COMPANIONWAY	99	99	90	0	0	0	80	88	72
02-58-1-L	LADDER	99	99	90	0	0	0	80	88	72
CUI=LW	**(Sanitary Spaces) Frequency of EB=0.0002**									
1-83-0-L	ENLISTED WR,WC&SH	90	90	72	0	0	0	70	77	63
1-83-2-L	ENLISTED WR,WC&SH	90	90	72	0	0	0	70	77	63
01-58-2-L	CPO WR,WC	90	90	72	0	0	0	70	77	63
01-66-1-L	CO WR,WC SHR	90	90	72	0	0	0	70	77	63
01-74-2-L	ENLISTED WR,WC&SH	90	90	72	0	0	0	70	77	63
01-83-2-L	ENLISTED WR,WC&SH	90	90	72	0	0	0	70	77	63

Table B.6.1 Probability of Flame Termination (page 2 of 2)

Plan ID	Compartment Name	I Values EB	I Values TBAR	I Values DBAR	A Values EB	A Values TBAR	A Values DBAR	M Values EB	M Values TBAR	M Values DBAR
CUI=QA	**(Aux Machinery Spaces) Frequency of EB=0.0029**									
3-15-0-E	HYDRAULIC EQPT RM	70	70	49	0	0	0	40	44	30
3-42-1-Q	POTABLE WATER EQPT RM	70	70	49	0	0	0	40	44	30
3-79-0-Q	PUMP ROOM	70	70	49	25	28	23	40	44	30
3-88-0-E	PROPULSION THRUSTER RM	10	11	6	25	28	23	30	60	40
CUI=QE	**(Emergency Aux Generator Rm) Frequency of EB=0.0204**									
02-68-2-E	EMERGENCY GEN RM	60	66	36	45	50	40	20	25	18
CUI=QF	**(Fan Room) Frequency of EB=0.0004**									
02-52-0-V	VOID	90	72	54	0	0	0	20	40	15
CUI=QG	**(Galley/ Pantry/ Scullery) Frequency of EB=0.0026**									
1-61-2-Q	GALLEY	40	40	24	0	0	0	30	42	24
1-76-2-Q	SCULLERY	40	40	24	0	0	0	30	42	24
CUI=QL	**(Laundry) Frequency of EB=0.0031**									
1-52-3-Q	CHANGE RM	40	50	30	0	0	0	20	30	12
1-58-1-Q	LAUNDRY	40	50	30	0	0	0	20	30	12
CUI=QO	**(Office Spaces) Frequency of EB=0.0004**									
1-52-2-Q	SHIP'S OFFICE	30	36	18	0	0	0	30	38	18
1-57-2-Q	ENG OFFICE AND DC CENTRAL	30	36	18	0	0	0	30	38	18
02-61-0-C	CHART ROOM	30	36	18	0	0	0	30	38	18
CUI=QS	**(Shops) Frequency of EB=0.0018**									
3-42-0-Q	MACHINE SHOP	30	20	10	0	0	0	20	40	10
3-57-1-Q	ELEC SHOP	30	20	10	0	0	0	20	40	10
1-6-1-Q	SERVICE LKR	30	20	10	0	0	0	20	40	10
1-6-2-Q	ATON SHOP	30	20	10	0	0	0	20	40	10
CUI=TU	**(Stacks/ Engine Uptakes) Frequency of EB=0.0013**									
1-70-1-Q	UPTAKE	20	22	12	0	0	0	20	26	12
02-70-0-Q	STACK	20	22	12	0	0	0	20	26	12
CUI=V	**(Voids/ Cofferdams) Frequency of EB=0.0001**									
3-0-0-V	FOREPEAK	99	99	99	0	0	0	99	99	99
3-15-0-V	VOID	99	99	99	0	0	0	99	99	99
3-24-0-V	VOID	99	99	99	0	0	0	99	99	99
3-35-0-V	VOID	99	99	99	0	0	0	99	99	99
3-4-0-V	VOID	99	99	99	0	0	0	99	99	99
3-42-0-V	VOID	99	99	99	0	0	0	99	99	99
3-52-0-V	VOID	99	99	99	0	0	0	99	99	99
3-6-0-V	VOID	99	99	99	0	0	0	99	99	99
3-79-0-V	VOID	99	99	99	0	0	0	99	99	99
3-88-0-V	VOID	99	99	99	0	0	0	99	99	99
01-51-0-V	VOID	90	90	90	0	0	0	90	90	90
CUI=W	**(Water Tank) Frequency of EB=0.0004**									
3-35-1-W	BALLAST TANK	99	99	99	0	0	0	99	99	99
3-35-2-W	BALLAST TANK	99	99	99	0	0	0	99	99	99
3-81-1-W	GRAY WTR HOLDING TNK	99	99	99	0	0	0	99	99	99
2-44-0-W	FRESH WATER TANK	99	99	99	0	0	0	99	99	99

B.7 FUEL LOADS

B.7.1 Cellulosics, Plastics and Flammable Liquids
B.7.2 Fuel Stack Height
B.7.3 Deck Area Occupied

SOURCES

- Fuel loads and percents of fuel stack height and deck area occupied were established in accordance with Chapter IV, Section C.3.3.2 of Reference D.
- Weights of combustible materials were determined in part from References K and L and estimated using engineering judgment.
- Contributions of barrier insulation to the fuel load was determined by multiplying the appropriate insulation standard value listed in Attachment B.7.1 by the area of the insulated barriers in a compartment as documented in Appendix C.

ASSUMPTIONS

General

- All cellulosic fuels were assumed to yield 8000 BTU per pound
- All plastic fuels and flammable liquids were assumed to yield 16000 BTU per pound
- All flammable liquids assumed to weigh 6.8 pounds per gallon
- All combustible materials contained within the structural or joiner boundaries of a compartment were assumed available for combustion

Hull Structure

- Assumed noncombustible

Electrical

- Cables area assumed to average 1" in diameter with an estimated weight of 0.75 lbs/ft. 25% of this weight is assumed to be insulation.
- Fluorescent lighting fixtures: Only the plexiglass translucent cover is considered combustible
- Relay operated and portable battle lanterns: Only the plastic case assumed combustible - no allowance for batteries.
- Contents of, and wires to, distribution boxes, receptacles and switches considered insignificant

Electronics

- Allowance of 5 pounds of plastic combustibles (wires, plastic plates, etc.) assumed for the contents of each major cabinet or console. Small boxes, speakers, telephones etc. considered insignificant

Outfit and Furnishings

- Interior painting assumed as negligible fuel load
- An allowance of 40 lbs per person is assumed for clothes and combustible personal effects
- An allowance of 30 lbs per bin or drawer is assumed for the combustible contents of storage lockers
- Deck coverings assumed to be totally combustible including weight of adhesives
- Insulation: Thermal insulation conforming to MIL-I-742C assumed incombustible with exception of binder. Binder assumed to equal 10% of the weight of the material
- Chairs: 4.5 pounds of combustibles (plastic) assumed for combustible padding in seats, and backs per person (3 person bench seat thus equals 13.5 lbs)
- Combustibles in Galley assumed to be two lbs of griddle grease/cooking oil, two lbs for each appliance and 40 lbs of combustible stores in cabinets

Auxiliary Machinery & Systems

- Ventilation ductwork and fittings, except insulation, assumed noncombustible
- PVC, and fiberglas reinforced piping assumed noncombustible due to non-flammable liquid in piping acting as heat sink.

DATA

- Table B.7.1 summarizes the fuel load densities for plastics (lbs/sq. ft.) and cellulosics (lbs/sq. ft.) as well as gallons of flammable liquids in each compartment
- The fuel stack height and deck area occupied is also tabulated in Table B.7.1 as a percent of compartment height.
- Attachment B.7.1 is a list of standard values used when developing fuel loads.
- Table B.7.2 are the worksheets used in determining fuel loads in individual compartments. The following is an index for Table B.7.2:

Table B.7.2 Index (continued)

Table B.7.2 Index (continued)

Table B.7.1 Fuel Loads (page 1 of 2)

Plan ID	Compartment Name	Cellulosics (psf)	Plastics (psf)	Flam. Liq. (Gals.)	Stack Ht. %	% Deck Occupied
CUI=AA	**(Cargo Holds)**					
2-24-0-AA	CARGO HOLD	4	0.3	0	6	50
CUI=AG	**(Gear Lockers)**					
2-4-1-A	CHAIN LKR	0	2.3	0	NA	10
2-4-2-A	CHAIN LKR	0	2.3	0	NA	10
1-0-0-Q	BOATSWAIN STRM	1.9	1.1	0	60	50
1-61-1-Q	REPAIR LKR	4.4	2.9	0	NA	75
1-76-1-A	CLEANING GEAR LOCKER	3.8	2.5	0	NA	75
01-53-1-A	CLEANING GEAR LOCKER	3.5	2.3	0	NA	75
01-67-1-A	LINEN LOCKER	14.6	2.9	0	NA	75
01-70-1-Q	BOAT LKR	8.4	8.7	0	NA	75
01-83-4-Q	TRASH LKR	3.8	0.3	0	65	75
02-61-1-Q	PFD LKR	14.3	0.2	0	NA	75
02-61-2-Q	PFD LKR	13.4	0.2	0	NA	75
02-68-1-Q	BATTERY LKR	8.3	8.9	0	75	75
CUI=AS	**(Storerooms)**					
3-47-1-Q	ENGRS STRM	2	0.2	0	NA	75
3-52-1-Q	ELEC/ELEX STRM	2.1	1.2	0	NA	75
1-77-1-A	SODA LKR	7.1	1.3	0	95	75
CUI=C	**(Ship Control, Communication)**					
3-52-0-C	ENGINEERING CONTROL CTR	4.1	0.2	0	NA	25
01-50-0-C	BUOY DECK CONTROL ROOM	4.2	0.6	0	NA	25
02-52-0-C	PILOTHOUSE	3.8	0.1	0	NA	25
CUI=EM	**(Main Propulsion-Mechanical)**					
3-6-0-E	BOW THRUSTER ROOM	0.6	0.4	0	NA	50
3-61-0-E	MAIN ENGINE ROOM	0.4	0.3	60	NA	75
CUI=K	**(Hazardous Material Storage)**					
1-6-3-Q	PAINT LKR	0.2	0.2	38	95	75
CUI=L1	**(Senior Officer's Cabin)**					
01-52-1-L	CO CABIN	3.6	1	0	NA	25
01-62-1-L	CO SR	4.8	0.7	0	NA	50
CUI=L2	**(Officer/CPO Quarters)**					
01-52-2-L	CPO SR (1)	5.2	0.9	0	NA	50
01-61-2-L	CPO SR (1)	4.2	0.9	0	NA	50
CUI=L5	**(Crews Berthing)**					
1-79-1-L	ENLISTED SR (4)	5.6	0.3	0	NA	50
1-79-2-L	ENLISTED SR (3+1)	5.7	0.3	0	NA	50
01-68-2-L	PO SR (2+2)	6.4	0.5	0	NA	50
01-76-0-L	ENLISTED SR (4)	5.5	0.3	0	NA	50
01-76-2-L	ENLISTED SR (2+2)	6	0.3	0	NA	50
CUI=LL	**(Wardroom/ Mess/ Lounge Area)**					
1-61-0-L	MESS ROOM	2.5	0.5	0	NA	50
CUI=LP	**(Passageway/Staircase/Vestibule)**					
3-35-0-Q	PASSAGE	1.3	0.3	0	NA	5
1-52-0-L	PASSAGE	3.6	0.2	0	NA	5
1-52-1-L	COMPANIONWAY	2.6	0.2	0	NA	5
1-79-0-L	COMPANIONWAY	1.2	0.2	0	NA	5
1-79-01-L	PASSAGE	3.7	0.2	0	NA	5
01-55-0-L	PASSAGE	3.5	0.1	0	NA	5
01-61-1-L	COMPANIONWAY	2.3	0.2	0	NA	5
02-58-1-L	LADDER	1.8	0.2	0	NA	5

Table B.7.1 Fuel Loads (page 2 of 2)

Plan ID	Compartment Name	Cellulosics (psf)	Plastics (psf)	Flam. Liq. (Gals.)	Stack Ht. %	% Deck Occupied
CUI=LW	**(Sanitary Spaces)**					
1-83-0-L	ENLISTED WR,WC&SH	1.4	0.2	0	NA	10
1-83-2-L	ENLISTED WR,WC&SH	1.4	0.2	0	NA	10
01-58-2-L	CPO WR,WC	1.4	0.3	0	NA	10
01-66-1-L	CO WR,WC SHR	1.8	0.3	0	NA	10
01-74-2-L	ENLISTED WR,WC&SH	1.5	0.2	0	NA	10
01-83-2-L	ENLISTED WR,WC&SH	1.4	0.2	0	NA	10
CUI=QA	**(Aux Machinery Spaces)**					
3-15-0-E	HYDRAULIC EQPT RM	0.5	0.4	35	NA	50
3-42-1-Q	POTABLE WATER EQPT RM	1.3	1.3	0	NA	50
3-79-0-Q	PUMP ROOM	0.4	0.3	0	NA	50
3-88-0-E	PROPULSION THRUSTER RM	0.1	1.6	5	40	50
CUI=QE	**(Emergency Aux Generator Rm)**					
02-68-2-E	EMERGENCY GEN RM	0.9	1.7	23	NA	50
CUI=QF	**(Fan Room)**					
02-52-0-V	VOID	0.2	0.2	0	NA	25
CUI=QG	**(Galley/ Pantry/ Scullery)**					
1-61-2-Q	GALLEY	2.1	0.5	0	NA	25
1-76-2-Q	SCULLERY	2.1	0.6	0	NA	25
CUI=QL	**(Laundry)**					
1-52-3-Q	CHANGE RM	2.1	0.5	0	NA	25
1-58-1-Q	LAUNDRY	3.7	1.8	0	NA	25
CUI=QO	**(Office Spaces)**					
1-52-2-Q	SHIP'S OFFICE	7.6	1.4	0	NA	50
1-57-2-Q	ENG OFFICE AND DC CENTRAL	7.3	1.3	0	NA	50
02-61-0-C	CHART ROOM	4.4	2	0	NA	25
CUI=QS	**(Shops)**					
3-42-0-Q	MACHINE SHOP	0.3	0.2	0	NA	50
3-57-1-Q	ELEC SHOP	0.5	0.5	0	NA	50
1-6-1-Q	SERVICE LKR	0.4	0.3	0	NA	25
1-6-2-Q	ATON SHOP	0.4	0.2	0	NA	25
CUI=TU	**(Stacks/ Engine Uptakes)**					
1-70-1-Q	UPTAKE	0.6	1.1	0	NA	25
02-70-0-Q	STACK	0.2	0.8	0	NA	25
CUI=V	**(Voids/ Cofferdams)**					
3-0-0-V	FOREPEAK	0	0	0	NA	0
3-15-0-V	VOID	0	0	0	NA	0
3-24-0-V	VOID	0	0	0	NA	0
3-35-0-V	VOID	0	0	0	NA	0
3-4-0-V	VOID	0	0	0	NA	0
3-42-0-V	VOID	0	0	0	NA	0
3-52-0-V	VOID	0	0	0	NA	0
3-6-0-V	VOID	0	0	0	NA	0
3-79-0-V	VOID	0	0	0	NA	0
3-88-0-V	VOID	0	0	0	NA	0
01-51-0-V	VOID	0.1	0.3	0	NA	10
CUI=W	**(Water Tank)**					
3-35-1-W	BALLAST TANK	0	0	0	NA	0
3-35-2-W	BALLAST TANK	0	0	0	NA	0
3-81-1-W	GRAY WTR HOLDING TNK	0	0	0	NA	0
2-44-0-W	FRESH WATER TANK	0	0	0	NA	0

Attachment B.7.1 Fuel Load Standard Values (page 1 of 2)

Deck/Bulkhead Materials	
Rubber mat and adhesive	1.76 lbs/sq ft
Nomex rug and blue glue	.396 lbs/sq ft
Vinyl asbestos tile & adhesive	1.22 lbs/sq ft
Acoustic Ceiling Panels	1.2 lbs/sq ft
Aluminum Sheathing w/ vinyl face	.033 lbs/sq ft
MJ Bulkhead Panel w/ vinyl face	.033 lbs/sq ft
MJ Bulkhead Panel w/ HP Laminate face	.21 lbs/sq ft
Insulation	
2" MIL-I-742C Hull Board (overhead)	.062 lbs/sq ft
1" MIL-I-742C Hull Board (shell)	.038 lbs/sq ft
29mm Fiberglass Insulation Batting	.153 lbs/sq ft
38mm Fiberglass Insulation Batting	.201 lbs/sq ft
66.5mm Fiberglass Insulation Batting	.344 lbs/sq ft
Office Furniture	
Laminate Top for Steel Desk	.077 lbs
Turnbull Chair	5.0 lbs
Type II chair w/ arms	4.5 lbs
Cork Bulletin Board	18.0 lbs
Type "A" Bulletin Board	42.0 lbs
Books on shelf	15 lbs/ft
Lighting Fixtures	
Fluorescent overhead (2 tube)	3.44 lbs
Incandescent globe	1.0 lbs
Spot light	2.0 lbs
Portable lantern	3.5 lbs
Relay operated lantern	4.75 lbs
Bunk light	.5 lbs
Lavatory fixture	1.2 lbs
Cableways	
17"/16"	2.81 lbs/ft
14"/13"	2.25 lbs/ft
12"/11"	1.88 lbs/ft
10"/9"	1.50 lbs/ft
8"/7"	1.13 lbs/ft
6"/5"	0.75 lbs/ft
Damage Control Equipment	
OBA unit w/ 4 extra canisters	32.4 lbs
Fireaxe	7 lbs
Damage Control Diagrams	4 lbs/set
P-250 Exhaust hose	15 lbs
P-250 Suction Hose	20 lbs

Attachment B.7.1 Fuel Load Standard Values (page 2 of 2)

Lifesaving Equipment	
CO2 Inflatable lifejacket	5.4 lbs
Kapok lifejacket	10.5 lbs
Jacobs ladder	30.0 lbs
Berthing Area Furnishings	
Transom Berth	24.1 lbs
Blankets (2), Sheets (2), Mattress, Pillow/case	34 lbs
Bunk privacy curtain	10 lbs
WR, WC, & SH Spaces Furnishings	
Shower stall door	10.6 lbs
Toilet paper roll	1.0 lbs
Toilet seat	6.0 lbs
Miscellaneous	
Accordion pleat curtain	1.5 lbs/sq ft
Clock	5 lbs
Push Broom	1.5 lbs
Storeroom Contents	
Hemp (1")	.293 lbs/ft
Nylon (1/2")	.071 lbs/ft
Bosun's Chair	8 lbs

Table B.7.2 Fuel Loads (page 1 of 26)

Fuel Loads - WLM (R)	Engineering Control Room, 3-52-0-C				
Compartment Use Indicator: C				Compartment Area:	310.8
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
Bulkhead Paneling	682		0.21	143.2	
Acoustic Ceiling Paneling	310.8		1.2	373.0	
Rubber Matting	310.8	0.75	1.76	410.3	
Vinyl Tile/Adhesive	310.8	0.75	1.22	284.4	
2" MIL-I-742F Insulation	993	0.5	0.047	23.3	
2 Tube Fluorescent Light Fixture	4		3.44		13.8
Cableways	25				25
Console	1		5		5.0
Type II Chair w/arms	2		4.5		9.0
Paper, logs, manuals, etc	25			25	
Total				1259.2	52.8
Fuel Load (per square foot)				4.1	0.2

Fuel Loads - WLM (R)	Pilothouse, 02-52-0-C				
Compartment Use Indicator: C				Compartment Area:	416.2
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
Bulkhead Paneling	552		0.21	115.9	
Acoustic Ceiling Paneling	416.2		1.2	499.4	
Rubber Matting	416.2	0.75	1.76	549.4	
Vinyl Tile/Adhesive	416.2	0.75	1.22	380.8	
2" MIL-I-742F Insulation	968	0.5	0.047	22.7	
2 Tube Fluorescent Light Fixture	5		3.44		17.2
Cableways	25				25
Console	1		5		5.0
Type II Chair w/arms	2		4.5		9.0
Paper, logs, manuals, etc	25			25	
Total				1593.3	56.2
Fuel Load (per square foot)				3.8	0.1

Table B.7.2 Fuel Loads (page 2 of 26)

Fuel Loads - WLM (R)	Buoy Deck Control Room, 01-50-0-C				
Compartment Use Indicator: C			Compartment Area:		90
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
Bulkhead Paneling	264		0.21	41.5	13.9
Acoustic Ceiling Paneling	90		1.2	108.0	
Rubber Matting	90	0.75	1.76	118.8	
Vinyl Tile/Adhesive	90	0.75	1.22	82.4	
2" MIL-I-742F Insulation	104	0.5	0.047	2.4	
2 Tube Fluorescent Light Fixture	1		3.44		3.4
Cableways	25				25
Console	1		5		5.0
Type II Chair w/arms	1		4.5		4.5
Paper, logs, manuals, etc	25			25	
Total				378.1	51.8
Fuel Load (per square foot)				4.2	0.6

Fuel Loads - WLM (R)	CO Cabin, 01-52-1-L				
Compartment Use Indicator: L1			Compartment Area:		148.2
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
Bulkhead Paneling	400		0.21	63.0	21.0
Acoustic Ceiling Paneling	148.2		1.2	177.8	
Wool Rug	148.2	0.75	0.396	44.0	
Vinyl Tile/Adhesive	148.2	0.75	1.22	135.6	
2" MIL-I-742F Insulation	548.2	0.5	0.047	12.9	
2 Tube Fluorescent Light Fixture	2		3.44		6.9
Cableways	10				10
Steel Desk Laminate Top	1		0.077		0.077
Desk Contents	1		25		25
Type II Chair w/arms	3		4.5		13.5
Stereo/VCR	2		5		10.0
Hanging Clothes in Closet	1		25	25.0	
Reclining Chair	1		25		25.0
Lamp and Table	1		20	20.0	
Small Arms Locker/contents	1		25		25.0
4-Drawer File Cabinet	4	0.5	25	50.0	
Ship Clock	1		5	5.0	
Entertainment Speakers	2		5		10.0
19" Television	1		5		5.0
Total				533.3	151.5
Fuel Load (per square foot)				3.6	1.0

Table B.7.2 Fuel Loads (page 3 of 26)

Fuel Loads - WLM (R)	CO Stateroom, 01-62-1-L				
Compartment Use Indicator: L1				Compartment Area:	83.2
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
Bulkhead Paneling	288		0.21	45.4	15.1
Acoustic Ceiling Paneling	83.2		1.2	99.8	
Wool Rug	83.2	0.75	0.396	24.7	
Vinyl Tile/Adhesive	83.2	0.75	1.22	76.1	
2" MIL-I-742F Insulation	371.2	0.5	0.047	8.7	
2 Tube Fluorescent Light Fixture	1		3.44		3.4
Cableways	10				10
Transom Berth	1		24.1	24.1	
Berth light	1		0.5		0.5
Blankets, Sheets, Mattress, Pillow	1		34	34.0	
Type II Chair w/arms	1		4.5		4.5
Steel desk laminate top	1		0.077		0.077
Desk Contents	1		25		25.0
Waste Basket/Trash	1		2	2.0	
Books on open shelf	2		15	30.0	
Hanging Clothes in closet	1		25	25.0	
Chest of Drawers/contents	1	0.5	50	25.0	
Ship Clock	1		5	5.0	
Total				399.9	58.6
Fuel Load (per square foot)				4.8	0.7

Table B.7.2 Fuel Loads (page 4 of 26)

Fuel Loads - WLM (R)	CPO Stateroom, 01-52-2-L				
Compartment Use Indicator: L2				Compartment Area:	90.2
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
Bulkhead Paneling	304		0.21	47.9	16.0
Acoustic Ceiling Paneling	90.2		1.2	108.2	
Wool Rug	90.2	0.75	0.396	26.8	
Vinyl Tile/Adhesive	90.2	0.75	1.22	82.5	
2" MIL-I-742F Insulation	394.2	0.5	0.047	9.3	
2 Tube Fluorescent Light Fixture	1		3.44		3.4
Cableways	10				10
Transom Berth	2		24.1	48.2	
Berth light	2		0.5		1.0
Blankets, Sheets, Mattress, Pillow	2		34	68.0	
Privacy curtain	2		10	20.0	
Type II Chair w/arms	1		4.5		4.5
Waste Basket/Trash	1		2	2.0	
Hanging Clothes in closet	1		25	25.0	
Chest of Drawers/contents	1	0.5	50	25.0	
Towel Rack/Towel	1		2	2.0	
Reclining Chair	1		25		25.0
Entertainment speakers	2		5		10.0
Stereo/VCR	2		5		10.0
19" Television	1		5		5.0
Total				464.9	84.9
Fuel Load (per square foot)				5.2	0.9

Table B.7.2 Fuel Loads (page 5 of 26)

Fuel Loads - WLM (R)	CPO Stateroom, 01-61-2-L				
Compartment Use Indicator: L2			Compartment Area:		90.7
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
Bulkhead Paneling	288		0.21	45.4	15.1
Acoustic Ceiling Paneling	90.7		1.2	108.8	
Wool Rug	90.7	0.75	0.396	26.9	
Vinyl Tile/Adhesive	90.7	0.75	1.22	83.0	
2" MIL-I-742F Insulation	378.7	0.5	0.047	8.9	
2 Tube Fluorescent Light Fixture	1		3.44		3.4
Cableways	10				10
Transom Berth	1		24.1	24.1	
Berth light	1		0.5		0.5
Blankets, Sheets, Mattress, Pillow	1		34	34.0	
Type II Chair w/arms	1		4.5		4.5
Waste Basket/Trash	1		2	2.0	
Hanging Clothes in closet	1		25	25.0	
Chest of Drawers/contents	1	0.5	50	25.0	
Towel Rack/Towel	1		2	2.0	
Reclining Chair	1		25		25.0
Entertainment Speakers	2		5		10.0
Stereo/VCR	2		5		10.0
19" Television	1		5		5.0
Total				385.1	83.6
Fuel Load (per square foot)				4.2	0.9

Fuel Loads - WLM (R)	Senior PO Stateroom, 01-68-2-L				
Compartment Use Indicator: L5			Compartment Area:		97.2
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
Bulkhead Paneling	320		0.21	50.4	16.8
Acoustic Ceiling Paneling	97.2		1.2	116.6	
Wool Rug	97.2	0.75	0.396	28.9	
Vinyl Tile/Adhesive	97.2	0.75	1.22	88.9	
2" MIL-I-742F Insulation	417.2	0.5	0.047	9.8	
2 Tube Fluorescent Light Fixture	1		3.44		3.4
Cableways	10				10
Transom Berth	4		24.1	96.4	
Berth light	4		0.5		2.0
Blankets, Sheets, Mattress, Pillow	4		34	136.0	
Privacy curtain	4		10	40.0	
Waste Basket/Trash	1		2	2.0	
Hanging Clothes in closet	2		25	50.0	
Towel Rack/Towel	2		2	4.0	
Stereo/speakers	2		5		10.0
19" Television	1		5		5.0
Total				623.1	47.2
Fuel Load (per square foot)				6.4	0.5

Table B.7.2 Fuel Loads (page 6 of 26)

Fuel Loads - WLM (R)	Enlisted Stateroom, 01-76-0-L				
Compartment Use Indicator: L5			Compartment Area:		140.4
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
Bulkhead Paneling	400		0.21	63.0	21.0
Acoustic Ceiling Paneling	140.4		1.2	168.5	
Wool Rug	140.4	0.75	0.396	41.7	
Vinyl Tile/Adhesive	140.4	0.75	1.22	128.5	
2" MIL-I-742F Insulation	540.4	0.5	0.047	12.7	
2 Tube Fluorescent Light Fixture	2		3.44		6.9
Cableways	10				10
Transom Berth	4		24.1	96.4	
Berth light	4		0.5		2.0
Blankets, Sheets, Mattress, Pillow	4		34	136.0	
Privacy Curtains	4		10	40.0	
Hanging Clothes in closet	4		20	80.0	
Towel Rack/Towel	4		2	8.0	
Total				774.7	39.9
Fuel Load (per square foot)				5.5	0.3

Fuel Loads - WLM (R)	Senior Enlisted Stateroom, 01-76-2-L				
Compartment Use Indicator: L5			Compartment Area:		104.4
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
Bulkhead Paneling	320		0.21	50.4	16.8
Acoustic Ceiling Paneling	104.4		1.2	125.3	
Wool Rug	104.4	0.75	0.396	31.0	
Vinyl Tile/Adhesive	104.4	0.75	1.22	95.5	
2" MIL-I-742F Insulation	424.4	0.5	0.047	10.0	
2 Tube Fluorescent Light Fixture	2		3.44		6.9
Cableways	10				10
Transom Berth	4		24.1	96.4	
Berth light	4		0.5		2.0
Blankets, Sheets, Mattress, Pillow	4		34	136.0	
Privacy curtain	4		10	40.0	
Waste Basket/Trash	1		2	2.0	
Hanging Clothes in closet	2		20	40.0	
Towel Rack/Towel	2		2	4.0	
Total				630.6	35.7
Fuel Load (per square foot)				6.0	0.3

Table B.7.2 Fuel Loads (page 7 of 26)

Fuel Loads - WLM (R) Compartment Use Indicator: L5	Enlisted Stateroom, 1-79-1-L		Compartment Area:		140.2
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
Bulkhead Paneling	442		0.21	69.6	23.2
Acoustic Ceiling Paneling	140.2		1.2	168.2	
Wool Rug	140.2	0.75	0.396	41.6	
Vinyl Tile/Adhesive	140.2	0.75	1.22	128.3	
2" MIL-I-742F Insulation	582.2	0.5	0.047	13.7	
2 Tube Fluorescent Light Fixture	2		3.44		6.9
Cableways	10				10
Transom Berth	4		24.1	96.4	
Berth light	4		0.5		2.0
Blankets, Sheets, Mattress, Pillow	4		34	136.0	
Privacy Curtains	4		10	40.0	
Hanging Clothes in closet	4		20	80.0	
Towel Rack/Towel	4		2	8.0	
Waste Basket/Trash	1		2	2.0	
Total				783.8	42.1
Fuel Load (per square foot)				5.6	0.3

Fuel Loads - WLM (R) Compartment Use Indicator: L5	Enlisted Stateroom, 1-79-2-L		Compartment Area:		125.6
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
Bulkhead Paneling	408		0.21	64.3	21.4
Acoustic Ceiling Paneling	125.6		1.2	150.7	
Wool Rug	125.6	0.75	0.396	37.3	
Vinyl Tile/Adhesive	125.6	0.75	1.22	114.9	
2" MIL-I-742F Insulation	533.6	0.5	0.047	12.5	
2 Tube Fluorescent Light Fixture	2		3.44		6.9
Cableways	10				10
Transom Berth	4		24.1	96.4	
Berth light	4		0.5		2.0
Blankets, Sheets, Mattress, Pillow	4		34	136.0	
Privacy curtain	4		10	40.0	
Waste Basket/Trash	1		2	2.0	
Hanging Clothes in closet	3		20	60.0	
Towel Rack/Towel	3		2	6.0	
Total				720.2	40.3
Fuel Load (per square foot)				5.7	0.3

Table B.7.2 Fuel Loads (page 8 of 26)

Fuel Loads - WLM (R)	Mess Room, 1-61-0-L				
Compartment Use Indicator: LL				Compartment Area:	529.4
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
Bulkhead Paneling	867		0.21	136.6	45.5
Acoustic Ceiling Paneling	529.4		1.2	635.3	
Vinyl Tile/Adhesive	529.4	0.75	1.22	484.4	
2" MIL-I-742F Insulation	1396.4	0.5	0.047	32.8	
2 Tube Fluorescent Light Fixture	6		3.44		20.6
Cableways	15				15
Mess Deck Table Laminate Top	5		0.077		0.385
Mess Deck Table Bench Seats	10		13.5		135
Stereo/Master VCR/Cabinet	1		15		15.0
Ship Clock	1		5	5.0	
Entertainment Speakers	2		5		10.0
19" Television	1		5		5.0
Medical Cabinet/contents	1	0.5	10	5.0	
Vending Machine	1		5		5.0
Water Cooler	1		5		5.0
Cup/Glass Rack	1		3		3.0
Ice Machine	1		5		5.0
Waste Basket/Trash	1		2	2.0	
Bulletin Board	1		42	42.0	
Coffee Maker	1		2		2.0
Milk Dispenser	1		5		5.0
Non-carbonated Beverage Mach	1		5		5.0
Total				1343.1	276.6
Fuel Load (per square foot)				2.5	0.5

Table B.7.2 Fuel Loads (page 9 of 26)

Fuel Loads - WLM (R)	Galley, 1-61-2-Q				
Compartment Use Indicator: QG				Compartment Area:	286.1
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
Bulkhead Paneling	510		0.21	80.3	26.8
Acoustic Ceiling Paneling	286.1		1.2	343.3	
2" MIL-I-742F Insulation	796.1	0.5	0.047	18.7	
2 Tube Fluorescent Light Fixture	3		3.44		10.3
Cableways	15				15
Griddle Grease/Cooking Oil	20				20
Foodstuffs in cabinets	40	0.5		20.0	
Slicing Machine	1		5		5.0
Microwave Oven	1		5		5.0
Toaster	1		5		5.0
Garbage Disposal	1		5		5.0
Sink Heater	1		5		5.0
Mixer	1		5		5.0
Deep Fat Fryer	1		5		5.0
Freezer, 20 cu ft	1		15		15.0
Refrigerator, 20 cu ft	1		15		15.0
Dry Stores, 130 cu ft	1		150	150.0	
Convection Oven	1		5		5.0
Total				612.4	142.1
Fuel Load (per square foot)				2.1	0.5

Fuel Loads - WLM (R)	Scullery, 1-76-2-Q				
Compartment Use Indicator: QG				Compartment Area:	74.4
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
Bulkhead Paneling	323		0.21	50.9	17.0
Acoustic Ceiling Paneling	74.4		1.2	89.3	
2" MIL-I-742F Insulation	397.4	0.5	0.047	9.3	
2 Tube Fluorescent Light Fixture	1		3.44		3.4
Cableways	15				15
Dishwasher	1		5		5
Foodstuffs in cabinets	20	0.5		10.0	
Garbage Disposal	1		5		5.0
Total				159.5	45.4
Fuel Load (per square foot)				2.1	0.6

Table B.7.2 Fuel Loads (page 10 of 26)

Fuel Loads - WLM (R)	Change Room, 1-52-3-Q				
Compartment Use Indicator: QL				Compartment Area:	150.3
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
Bulkhead Paneling	468		0.21	73.7	24.6
Acoustic Ceiling Paneling	150.3		1.2	180.4	
2" MIL-I-742F Insulation	618.3	0.5	0.047	14.5	
2 Tube Fluorescent Light Fixture	2		3.44		6.9
Cableways	10				10
Clothes in Storage Racks	100	0.5		50.0	25
Water Cooler	1		5		5
Total				318.6	71.5
Fuel Load (per square foot)				2.1	0.5

Fuel Loads - WLM (R)	Laundry, 1-58-1-Q				
Compartment Use Indicator: QL				Compartment Area:	48
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
Bulkhead Paneling	255		0.21	40.2	13.4
Acoustic Ceiling Paneling	48		1.2	57.6	
2 Tube Fluorescent Light Fixture	1		3.44		3.4
Cableways	10				10
Clothes in Laundry Bags				75.0	50
Washer	1		5		5
Dryer	1		5	5.0	5.0
Total				177.8	86.8
Fuel Load (per square foot)				3.7	1.8

Fuel Loads - WLM (R)	Chart Room, 02-61-0-C				
Compartment Use Indicator: QO				Compartment Area:	158.1
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
Bulkhead Paneling	400		0.21	63.0	21.0
Acoustic Ceiling Paneling	158.1		1.2	189.7	
Rubber Matting	158.1	0.75	1.76	208.7	
Vinyl Tile/Adhesive	158.1	0.75	1.22	144.7	
2" MIL-I-742F Insulation	342	0.5	0.047	8.0	
2 Tube Fluorescent Light Fixture	2		3.44		6.9
Cableways	150				150
Console	4		5		20.0
Type II Chair w/arms	2		4.5		9.0
Paper, logs, manuals, etc	150	0.5		75	
Electronic Equipment	20		5		100
Gyrocompass	1		5		5.0
Total				689.1	311.9
Fuel Load (per square foot)				4.4	2.0

Table B.7.2 Fuel Loads (page 11 of 26)

Fuel Loads - WLM (R)	Ship's Office, 1-52-2-Q				
Compartment Use Indicator: QO			Compartment Area:		100.6
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
Bulkhead Paneling	340		0.21	53.6	17.9
Acoustic Ceiling Paneling	100.6		1.2	120.7	
Rubber Matting	100.6	0.75	1.76	132.8	
Vinyl Tile/Adhesive	100.6	0.75	1.22	92.0	
2" MIL-I-742F Insulation	440.6	0.5	0.047	10.4	
2 Tube Fluorescent Light Fixture	2		3.44		6.9
Cableways	75				75
Laminated Table Tops	2		0.077		0.2
Type II Chair w/arms	2		4.5		9.0
Paper, logs, manuals, etc	150	0.5		75	
Books on Open Shelf	6		15	90.0	
Electric Typewriter	1		5		5.0
Desk Lamp	1		5		5.0
Ship Clock	1		5		5.0
Laser Jet Printer	1		5		5.0
Waste Basket/Trash	1		2	2.0	
4-Drawer File Cabinets	8	0.5	25	100.0	
Stationary Supplies in Locker	100	0.5		50.0	
Microfiche Reader	1		5		5.0
Copy Machine	1		5		5.0
Bulletin Board	1		42	42.0	
Total				768.5	138.9
Fuel Load (per square foot)				7.6	1.4

Table B.7.2 Fuel Loads (page 12 of 26)

Fuel Loads - WLM (R)	Engineer's Office, 1-57-2-Q				
Compartment Use Indicator: QO				Compartment Area:	100.6
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
Bulkhead Paneling	340		0.21	53.6	17.9
Acoustic Ceiling Paneling	100.6		1.2	120.7	
Vinyl Tile/Adhesive	100.6	0.75	1.22	92.0	
2" MIL-I-742F Insulation	440.6	0.5	0.047	10.4	
2 Tube Fluorescent Light Fixture	2		3.44		6.9
Cableways	75				75
Laminated Table Tops	2		0.077		0.2
Type II Chair w/arms	2		4.5		9.0
Paper, logs, manuals, etc	150	0.5		75	
Books on Open Shelf	6		15	90.0	
Electric Typewriter	1		5		5.0
Desk Lamp	1		5		5.0
Ship Clock	1		5		5.0
Laser Jet Printer	1		5		5.0
Waste Basket/Trash	1		2	2.0	
4-Drawer File Cabinets	4	0.5	25	50.0	
Microfiche Reader	1		5		5.0
3-shelf Bookcase w/Books	1	0.5	90	45.0	
Chart Table w/ Blueprints	1	0.5	400	200.0	
Total				738.7	133.9
Fuel Load (per square foot)				7.3	1.3

Fuel Loads - WLM (R)	Machine Shop, 3-42-0-Q				
Compartment Use Indicator: QS				Compartment Area:	280.8
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
2" MIL-I-742F Insulation	820		0.047	38.5	
2 Tube Fluorescent Light Fixture	3		3.44		10.3
Cableways	25				25
Lathe	1		5		5.0
Drill Press	1		5		5.0
Cabinets w/ contents	75	0.5		37.5	
Waste Basket/Trash	1		2	2.0	
Total				78.0	45.3
Fuel Load (per square foot)				0.3	0.2

Table B.7.2 Fuel Loads (page 13 of 26)

Fuel Loads - WLM (R)	Electric Shop, 3-57-1-Q				
Compartment Use Indicator: QS				Compartment Area:	105.1
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
2" MIL-I-742F Insulation	182		0.047	8.6	
2 Tube Fluorescent Light Fixture	2		3.44		6.9
Cableways	25				25
Test Bench	1		25		25.0
Cabinets w/ contents	75	0.5		37.5	
Waste Basket/Trash	1		2	2.0	
Total				48.1	56.9
Fuel Load (per square foot)				0.5	0.5

Fuel Loads - WLM (R)	Service Locker, 1-6-1-Q				
Compartment Use Indicator: QS				Compartment Area:	102
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
2" MIL-I-742F Insulation	136		0.047	6.4	
2 Tube Fluorescent Light Fixture	2		3.44		6.9
Cableways	25				25
Cabinets w/ contents	75	0.5		37.5	
Waste Basket/Trash	1		2	2.0	
Total				45.9	31.9
Fuel Load (per square foot)				0.4	0.3

Fuel Loads - WLM (R)	AtoN Shop, 1-6-2-Q				
Compartment Use Indicator: QS				Compartment Area:	199.5
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
2" MIL-I-742F Insulation	667		0.047	31.3	
2 Tube Fluorescent Light Fixture	2		3.44		6.9
Cableways	25				25
Cabinets w/ contents	75	0.5		37.5	
Waste Basket/Trash	1		2	2.0	
Total				70.8	31.9
Fuel Load (per square foot)				0.4	0.2

Table B.7.2 Fuel Loads (page 14 of 26)

Fuel Loads - WLM (R)	Uptake, 1-70-1-Q				
Compartment Use Indicator: TU			Compartment Area:		66
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
2" MIL-I-742F Insulation	761		0.047	35.8	
Incandescent Globe Lights	4		1	4.0	
Electrical Equipment	25				25.0
Cableways	50				50
Total				39.8	75.0
Fuel Load (per square foot)				0.6	1.1

Fuel Loads - WLM (R)	Stack, 02-70-0-Q				
Compartment Use Indicator: TU			Compartment Area:		60.3
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
Incandescent Globe Lights	4		1	4.0	
Muffler Insulation	200		0.047	9.4	
Cableways	50				50
Total				13.4	50.0
Fuel Load (per square foot)				0.2	0.8

Fuel Loads - WLM (R)	Paint Locker, 1-6-3-Q					
Compartment Use Indicator: K			Compartment Area:		97.5	
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic	Gals Liq
2" MIL-I-742F Insulation	314		0.047	14.8		
Incandescent Globe Lights	4		1	4.0		
Cableways	15				15	
Paint	75	0.5	8			37.5
Total				18.8	15.0	37.5
Fuel Load (per square foot)				0.2	0.2	3.1

Fuel Loads - WLM (R)	Engineer's Storeroom, 3-47-1-Q				
Compartment Use Indicator: AS			Compartment Area:		110.1
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
2" MIL-I-742F Insulation	253		0.047	11.9	
Fluorescent Light Fixtures	2		3.44		6.9
Cableways	15				15
Spare Parts in Metal Parts Boxes	15	0.5	15	112.5	
Spare Parts on Open Shelves	100			100.0	
Total				224.4	21.9
Fuel Load (per square foot)				2.0	0.2

Table B.7.2 Fuel Loads (page 15 of 26)

Fuel Loads - WLM (R)	Electrical/Electronics Storeroom, 3-52-1-Q				
Compartment Use Indicator: AS				Compartment Area:	105.1
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
2" MIL-I-742F Insulation	77		0.047	3.6	
Fluorescent Light Fixtures	2		3.44		6.9
Cableways	15				15
Spare Parts in Metal Parts Boxes	15	0.5	15	112.5	56.25
Spare Parts on Open Shelves	100			100.0	50
Total				216.1	128.1
Fuel Load (per square foot)				2.1	1.2

Fuel Loads - WLM (R)	Soda Locker, 1-77-1-A				
Compartment Use Indicator: AS				Compartment Area:	14.4
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
2" MIL-I-742F Insulation	57		0.047	2.7	
Fluorescent Light Fixtures	1		3.44		3.4
Cableways	15				15
Combustible Stowage	100			100	
Total				102.7	18.4
Fuel Load (per square foot)				7.1	1.3

Fuel Loads - WLM (R)	PFD locker, 02-61-1-Q				
Compartment Use Indicator: AG				Compartment Area:	37.8
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
2" MIL-I-742F Insulation	134		0.047	6.3	
Fluorescent Light Fixtures	1		3.44		3.4
Cableways	5				5
Survival Suits	15		25	375	
Personal Flotation Devices	15		10.5	157.5	
Total				538.8	8.4
Fuel Load (per square foot)				14.3	0.2

Fuel Loads - WLM (R)	PFD Locker, 02-61-2-Q				
Compartment Use Indicator: AG				Compartment Area:	40.1
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
2" MIL-I-742F Insulation	112		0.047	5.3	
Fluorescent Light Fixtures	1		3.44		3.4
Cableways	5				5
Survival Suits	15		25	375	
Personal Flotation Devices	15		10.5	157.5	
Total				537.8	8.4
Fuel Load (per square foot)				13.4	0.2

Table B.7.2 Fuel Loads (page 16 of 26)

Fuel Loads - WLM (R)	Boat locker, 01-70-1-Q				
Compartment Use Indicator: AG			Compartment Area:		12.5
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
2" MIL-I-742F Insulation	117		0.047	5.5	
Fluorescent Light Fixtures	1		3.44		3.4
Cableways	5				5
Boat Gear	200			100	100
Total				105.5	108.4
Fuel Load (per square foot)				8.4	8.7

Fuel Loads - WLM (R)	Trash Locker, 01-83-4-Q				
Compartment Use Indicator: AG			Compartment Area:		28.2
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
2" MIL-I-742F Insulation	164		0.047	7.7	
Fluorescent Light Fixtures	1		3.44		3.4
Cableways	5				5
Trash	100			100	
Total				107.7	8.4
Fuel Load (per square foot)				3.8	0.3

Fuel Loads - WLM (R)	Battery Locker, 02-68-1-Q				
Compartment Use Indicator: AG			Compartment Area:		12.2
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
2" MIL-I-742F Insulation	28		0.047	1.3	
Fluorescent Light Fixtures	1		3.44		3.4
Cableways	5				5
Batteries	200			100	100
Total				101.3	108.4
Fuel Load (per square foot)				8.3	8.9

Fuel Loads - WLM (R)	Repair Locker, 1-61-1-Q				
Compartment Use Indicator: AG			Compartment Area:		38
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
Fluorescent Light Fixtures	1		3.44		3.4
Cableways	5				5
OBA Unit w/ 4 extra Canisters	2	0.5	32.4	32.4	
P-250 Suction Hose	1		20	20.0	
P-250 Exhaust Hose	1		15	15.0	
Misc Damage Control Gear	200			100	100
Total				167.4	108.4
Fuel Load (per square foot)				4.4	2.9

Table B.7.2 Fuel Loads (page 17 of 26)

Fuel Loads - WLM (R)	Cleaning Gear Locker, 1-76-1-A				
Compartment Use Indicator: AG			Compartment Area:		13.4
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
2" MIL-I-742F Insulation	39	0.5	0.047	0.9	
Fluorescent Light Fixtures	1		3.44		3.4
Cableways	5				5
Cleaning Fluids	25				25
Mops, Brooms, Rags, etc	50			50	
Total				50.9	33.4
Fuel Load (per square foot)				3.8	2.5

Fuel Loads - WLM (R)	Cleaning Gear Locker, 01-53-1-A				
Compartment Use Indicator: AG			Compartment Area:		14.4
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
Fluorescent Light Fixtures	1		3.44		3.4
Cableways	5				5
Cleaning Fluids	25				25
Mops, Brooms, Rags, etc	50			50.0	
Total				50.0	33.4
Fuel Load (per square foot)				3.5	2.3

Fuel Loads - WLM (R)	Chain Locker, 2-4-1-A				
Compartment Use Indicator: AG			Compartment Area:		10.9
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
Paint on Chain	25				25
Total				0.0	25.0
Fuel Load (per square foot)				0.0	2.3

Fuel Loads - WLM (R)	Chain Locker, 2-4-2-A				
Compartment Use Indicator: AG			Compartment Area:		10.9
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
Paint on Chain	25				25
Total				0.0	25.0
Fuel Load (per square foot)				0.0	2.3

Table B.7.2 Fuel Loads (page 18 of 26)

Fuel Loads - WLM (R)	Cargo Hold, 2-24-0-AA				
Compartment Use Indicator: AA			Compartment Area:		577.8
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
2" MIL-I-742F Insulation	1205		0.047	56.6	
Fluorescent Light Fixtures	6		3.44		20.6
Cableways	25				25
2.5" Rubber Fuel Hose	400		2	800	
2.5" Rubber Fuel Hose	600		2	1200	
Misc Stowage	250			250	125
Total				2306.6	170.6
Fuel Load (per square foot)				4.0	0.3

Fuel Loads - WLM (R)	Boatswains Storeroom,1-0-0-Q				
Compartment Use Indicator: AG			Compartment Area:		145.4
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
2" MIL-I-742F Insulation	451		0.047	21.2	
Fluorescent Light Fixtures	2		3.44		6.9
Cableways	25				25
Misc Stowage	375			250	125
Total				271.2	156.9
Fuel Load (per square foot)				1.9	1.1

Fuel Loads - WLM (R)	CO WR,WC, & SHR, 01-66-1-L				
Compartment Use Indicator: LW			Compartment Area:		39.5
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
Bulkhead Paneling	224		0.21	47.0	
Overhead Paneling	39.5		0.21	8.3	
2" MIL-I-742F Insulation	96	0.5	0.047	2.3	
Fluorescent Light Fixtures	1		3.44		3.4
Cableways	5				5
Toilet Paper	1		1	1.0	
Toilet Seat	1		6	6.0	
Shower Curtain	1		2		2
Towel Rack w/Towels	1		2	2.0	
Medicine Cabinet w/ contents	1		5	5	2.5
Total				71.6	12.9
Fuel Load (per square foot)				1.8	0.3

Table B.7.2 Fuel Loads (page 19 of 26)

Fuel Loads - WLM (R)	CPO WR,WC, & SHR, 01-58-2-L				
Compartment Use Indicator: LW			Compartment Area:		51.1
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
Bulkhead Paneling	224		0.21	47.0	
Overhead Paneling	51.1		0.21	10.7	
2" MIL-I-742F Insulation	91	0.5	0.047	2.1	
Fluorescent Light Fixtures	1		3.44		3.4
Cableways	5				5
Toilet Paper	1		1	1.0	
Toilet Seat	1		6	6.0	
Shower Curtain	1		2		2
Towel Rack wTowels	1		2	2.0	
Medicine Cabinet w/ contents	1		5	5	2.5
Total				73.9	12.9
Fuel Load (per square foot)				1.4	0.3

Fuel Loads - WLM (R)	Enlisted WR,WC, & SHR, 1-83-2-L				
Compartment Use Indicator: LW			Compartment Area:		57.4
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
Bulkhead Paneling	255		0.21	53.6	
Overhead Paneling	57.4		0.21	12.1	
2" MIL-I-742F Insulation	117	0.5	0.047	2.7	
Fluorescent Light Fixtures	1		3.44		3.4
Cableways	5				5
Toilet Paper	1		1	1.0	
Toilet Seat	1		6	6.0	
Shower Curtain	1		2		2
Towel Rack w/Towels	1		2	2.0	
Medicine Cabinet w/ contents	1		5	5	2.5
Total				82.4	12.9
Fuel Load (per square foot)				1.4	0.2

Table B.7.2 Fuel Loads (page 20 of 26)

Fuel Loads - WLM (R)	Enlisted WR,WC, & SHR, 1-83-0-L				
Compartment Use Indicator: LW			Compartment Area:		60.7
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
Bulkhead Paneling	255		0.21	53.6	
Overhead Paneling	60.7		0.21	12.7	
2" MIL-I-742F Insulation	120		0.047	5.6	
Fluorescent Light Fixtures	1		3.44		3.4
Cableways	5				5
Toilet Paper	1		1	1.0	
Toilet Seat	1		6	6.0	
Shower Curtain	1		2		2
Towel Rack wTowels	1		2	2.0	
Medicine Cabinet w/ contents	1		5	5	2.5
Total				85.9	12.9
Fuel Load (per square foot)				1.4	0.2

Fuel Loads - WLM (R)	Enlisted WR,WC, & SHR, 01-74-2-L				
Compartment Use Indicator: LW			Compartment Area:		53.3
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
Bulkhead Paneling	240		0.21	50.4	
Overhead Paneling	53.3		0.21	11.2	
2" MIL-I-742F Insulation	93	0.5	0.047	2.2	
Fluorescent Light Fixtures	1		3.44		3.4
Cableways	5				5
Toilet Paper	1		1	1.0	
Toilet Seat	1		6	6.0	
Shower Curtain	1		2		2
Towel Rack w/Towels	1		2	2.0	
Medicine Cabinet w/ contents	1		5	5	2.5
Total				77.8	12.9
Fuel Load (per square foot)				1.5	0.2

Table B.7.2 Fuel Loads (page 21 of 26)

Fuel Loads - WLM (R)	Enlisted WR,WC, & SHR, 01-83-2-L				
Compartment Use Indicator: LW			Compartment Area:		55
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
Bulkhead Paneling	240		0.21	50.4	
Overhead Paneling	55		0.21	11.6	
2" MIL-I-742F Insulation	127	0.5	0.047	3.0	
Fluorescent Light Fixtures	1		3.44		3.4
Cableways	5				5
Toilet Paper	1		1	1.0	
Toilet Seat	1		6	6.0	
Shower Curtain	1		2		2
Towel Rack wTowels	1		2	2.0	
Medicine Cabinet w/ contents	1		5	5	2.5
Total				78.9	12.9
Fuel Load (per square foot)				1.4	0.2

Fuel Loads - WLM (R)	Ladder, 02-58-1-L				
Compartment Use Indicator: LP			Compartment Area:		48.2
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
Bulkhead Paneling	144		0.21	30.2	
Acoustic Ceiling Paneling	48.2		1.2	57.8	
Fluorescent Light Fixtures	1		3.44		3.4
Cableways	5				5
Total				88.1	8.4
Fuel Load (per square foot)				1.8	0.2

Fuel Loads - WLM (R)	Companionway, 01-61-1-L				
Compartment Use Indicator: LP			Compartment Area:		38
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
Bulkhead Paneling	208		0.21	43.7	
Acoustic Ceiling Paneling	38		1.2	45.6	
Fluorescent Light Fixtures	1		3.44		3.4
Cableways	5				5
Total				89.3	8.4
Fuel Load (per square foot)				2.3	0.2

Table B.7.2 Fuel Loads (page 22 of 26)

Fuel Loads - WLM (R)	Companionway, 1-52-1-L				
Compartment Use Indicator: LP			Compartment Area:		34
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
Bulkhead Paneling	221		0.21	46.4	
Acoustic Ceiling Paneling	34		1.2	40.8	
2" MIL-I-742F Insulation	26	0.5	0.047	0.6	
Fluorescent Light Fixtures	1		3.44		3.4
Cableways	5				5
Total				87.8	8.4
Fuel Load (per square foot)				2.6	0.2

Fuel Loads - WLM (R)	Companionway, 1-79-0-L				
Compartment Use Indicator: LP			Compartment Area:		35.8
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
Bulkhead Paneling	0		0.21	0.0	
Acoustic Ceiling Paneling	35.8		1.2	43.0	
Fluorescent Light Fixtures	1		3.44		3.4
Cableways	5				5
Total				43.0	8.4
Fuel Load (per square foot)				1.2	0.2

Fuel Loads - WLM (R)	Passageway, 01-55-0-L				
Compartment Use Indicator: LP			Compartment Area:		239.1
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
Bulkhead Paneling	1168		0.21	245.3	
Acoustic Ceiling Paneling	239.1		1.2	286.9	
2" MIL-I-742F Insulation	271	0.5	0.047	6.4	
Vinyl Tile/Adhesive	239.1		1.22	291.7	
Fluorescent Light Fixtures	3		3.44		10.3
Cableways	10				10
Total				830.3	20.3
Fuel Load (per square foot)				3.5	0.1

Table B.7.2 Fuel Loads (page 23 of 26)

Fuel Loads - WLM (R)	Passageway, 1-52-0-L				
Compartment Use Indicator: LP			Compartment Area:		63.7
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
Bulkhead Paneling	365.5		0.21	76.8	
Acoustic Ceiling Paneling	63.7		1.2	76.4	
2" MIL-I-742F Insulation	8.5	0.5	0.047	0.2	
Vinyl Tile/Adhesive	63.7		1.22	77.7	
Fluorescent Light Fixtures	1		3.44		3.4
Cableways	10				10
Total				231.1	13.4
Fuel Load (per square foot)				3.6	0.2

Fuel Loads - WLM (R)	Passageway, 3-35-0-Q				
Compartment Use Indicator: LP			Compartment Area:		41.8
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
2" MIL-I-742F Insulation	42		0.047	2.0	
Vinyl Tile/Adhesive	41.8		1.22	51.0	
Fluorescent Light Fixtures	1		3.44		3.4
Cableways	10				10
Total				53.0	13.4
Fuel Load (per square foot)				1.3	0.3

Fuel Loads - WLM (R)	Passageway, 1-79-01-L				
Compartment Use Indicator: LP			Compartment Area:		56.3
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
Bulkhead Paneling	348.5		0.21	73.2	
Acoustic Ceiling Paneling	56.3		1.2	67.6	
Vinyl Tile/Adhesive	56.3		1.22	68.7	
Fluorescent Light Fixtures	1		3.44		3.4
Cableways	10				10
Total				209.4	13.4
Fuel Load (per square foot)				3.7	0.2

Table B.7.2 Fuel Loads (page 24 of 26)

Fuel Loads - WLM (R)	Propulsion Thruster Room, 3-88-0-E					
Compartment Use Indicator: EE			Compartment Area:		682	
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic	Gals Liq
2" MIL-I-742F Insulation	1668		0.047	78.4		
2 Tube Fluorescent Light Fixture	7		3.44		24.1	
Cableways	50				50	
3.5" nylon mooring line on reels	300	0.5	0.87		130.5	
3.5" nylon mooring line on reels	600	0.5	0.87		261.0	
4.5" nylon towing hawser on reel	900	0.5	1.44		648.0	
Gear Oil	10	0.5	8			5.0
Total				78.4	1113.6	5.0
Fuel Load (per square foot)				0.1	1.6	0.1

Fuel Loads - WLM (R)	Main Engine Room, 3-61-0-E					
Compartment Use Indicator: EM			Compartment Area:		1063	
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic	Gals Liq
2" MIL-I-742F Insulation	2861		0.047	134.5		
2 Tube Fluorescent Light Fixture	11		3.44		37.8	
Cableways	75				75	
10 gallons of oil in bilge	10		8			10.0
Various Electrical Motors	12		5		60.0	
Rags in Barrels	2		25	50.0		
Flammable liquids in piping	100	0.5	8			50.0
Rubber hoses	100			100.0		
Plastic gages and meters, etc	100				100.0	
Misc combustibles	150			100.0	50.0	
Total				384.5	322.8	60.0
Fuel Load (per square foot)				0.4	0.3	0.5

Fuel Loads - WLM (R)	Emergency Generator Room, 02-68-2-E					
Compartment Use Indicator: QE			Compartment Area:		131.4	
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic	Gals Liquid
2" MIL-I-742F Insulation	531	0.5	0.047	12.5		
2 Tube Fluorescent Light Fixture	2		3.44		6.9	
Cableways	75				75	
10 gallons of oil in bilge	10		8			10.0
Switchboard	1		100		100.0	
Rags in Barrels	2		25	50.0		
Flammable liquids in piping	25	0.5	8			12.5
Rubber hoses	25			25.0		
Plastic gages and meters, etc	25				25.0	
Misc combustibles	25			25.0	12.5	
Total				112.5	219.4	22.5
Fuel Load (per square foot)				0.9	1.7	1.4

Table B.7.2 Fuel Loads (page 25 of 26)

Fuel Loads - WLM (R)	Hydraulic Equipment Room, 3-15-0-E					
Compartment Use Indicator: QA			Compartment Area:		405	
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic	Gals Liquid
2" MIL-I-742F Insulation	705		0.047	33.1		
2 Tube Fluorescent Light Fixture	5		3.44		17.2	
Cableways	50				50	
10 gallons of oil in bilge	10		8			10.0
Rags in Barrels	2		25	50.0		
Flammable liquids in piping	50	0.5	8			25.0
Rubber hoses	50			50.0		
Plastic gages and meters, etc	25				25.0	
Various Motors	6		5		30.0	
Misc combustibles	50			50.0	25.0	
Total				183.1	147.2	35.0
Fuel Load (per square foot)				0.5	0.4	0.7

Fuel Loads - WLM (R)	Potable Water Equipment Room, 3-42-1-Q				
Compartment Use Indicator: QA			Compartment Area:		107
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
2" MIL-I-742F Insulation	399		0.047	18.8	
2 Tube Fluorescent Light Fixture	2		3.44		6.9
Cableways	50				50
Rags in Barrels	2		25	50.0	
Rubber hoses	25			25.0	
Plastic gages and meters, etc	25				25.0
Various Motors	6		5		30.0
Misc combustibles	50			50.0	25.0
Total				143.8	136.9
Fuel Load (per square foot)				1.3	1.3

Fuel Loads - WLM (R)	Pump Room, 3-79-0-Q				
Compartment Use Indicator: QA			Compartment Area:		508.1
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
2" MIL-I-742F Insulation	615		0.047	28.9	
2 Tube Fluorescent Light Fixture	6		3.44		20.6
Cableways	50				50
Rags in Barrels	2		25	50.0	
Rubber hoses	50			50.0	
Plastic gages and meters, etc	25				25.0
Various Motors	6		5		30.0
Misc combustibles	50			50.0	25.0
Total				178.9	150.6
Fuel Load (per square foot)				0.4	0.3

Table B.7.2 Fuel Loads (page 26 of 26)

Fuel Loads - WLM (R)	Bow Thruster Room, 3-6-0-E				
Compartment Use Indicator: QE				Compartment Area:	279
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
2" MIL-I-742F Insulation	558		0.047	26.2	
2 Tube Fluorescent Light Fixture	3		3.44		10.3
Cableways	50				50
Rags in Barrels	2		25	50.0	
Rubber hoses	50			50.0	
Plastic gages and meters, etc	25				25.0
Bow Thruster Motor	1		15		15.0
Misc combustibles	50			50.0	25.0
Total				176.2	125.3
Fuel Load (per square foot)				0.6	0.4

Fuel Loads - WLM (R)	Void, 02-52-0-Q				
Compartment Use Indicator: QF				Compartment Area:	324.1
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
2" MIL-I-742F Insulation	1124		0.047	52.8	
2 Tube Fluorescent Light Fixture	4		3.44		13.8
Cableways	25				25
HVAC Equipment	2		5		10
Total				52.8	48.8
Fuel Load (per square foot)				0.2	0.2

Fuel Loads - WLM (R)	Void, 01-51-0-V				
Compartment Use Indicator: V				Compartment Area:	90
Combustible Contents	Quantity	Multiplier	Unit Weight	Lbs Cellulosic	Lbs Plastic
2" MIL-I-742F Insulation	242		0.047	11.4	
2 Tube Fluorescent Light Fixture	1		3.44		3.4
Cableways	25				25
Total				11.4	28.4
Fuel Load (per square foot)				0.1	0.3

B.8 FIRE GROWTH MODELS, RATES AND FRI TIMES

B.8.1 Fire Growth Models (FGM)
B.8.2 Pre FRI Fire Growth Rates (Alpha)
B.8.3 Maximum Heat Release Rates (Qmax)
B.8.4 FRI Times
B.8.5 Post FRI Heat Release Rates (Post FRI Q)

SOURCES

- Fire Growth Model (FGM) numbers are the only data assigned by the analyst in Appendix B.8. Fire growth models were assigned by engineering judgment and based on the definitions contained in Table C-1, Appendix C, of Reference F.
- Fire growth and heat release rates were determined by formula assigned to individual FGM shown in Appendix C of Reference F.
- FRI times were calculated using the Beyler-Peatross Algorithm incorporated in SAFE Version 2.1a.

ASSUMPTIONS

- None

DATA

- Table B.8.1 documents the various fire growth data and FRI times for each compartment.

Table B.8.1 Fire Growth Models, Rates, and FRI Times (page 1 of 2)

Plan ID	Compartment Name	Growth Model	Alpha kW/sec.sq	Maximum Q KW	FRI Time (Min.) XRAY	YOKE	ZEBRA	Post-FRI Q (kW) XRAY	YOKE	ZEBRA
CUI=AA	(Cargo Holds)									
2-24-0-AA	CARGO HOLD	1	0.100	106769	3	3	3	8066	1844	136
CUI=AG	(Gear Lockers)									
2-4-1-A	CHAIN LKR	16	0.001	3	∞	∞	∞	3	3	3
2-4-2-A	CHAIN LKR	16	0.001	3	∞	∞	∞	3	3	3
1-0-0-Q	BOATSWAIN STRM	2	0.010	30344	5	5	5	3389	1599	42
1-61-1-Q	REPAIR LKR	5	0.100	1744	1	1	1	120	120	120
1-76-1-A	CLEANING GEAR LOCKER	5	0.100	531	1	1	1	120	120	120
01-53-1-A	CLEANING GEAR LOCKER	5	0.100	525	1	1	1	120	120	120
01-67-1-A	LINEN LOCKER	12	0.100	1758	1	1	1	0	0	0
01-70-1-Q	BOAT LKR	5	0.100	1451	1	1	1	1451	1451	24
01-83-4-Q	TRASH LKR	2	0.010	9641	3	3	3	4695	3637	24
02-61-1-Q	PFD LKR	12	0.100	7043	2	2	2	4695	3637	24
02-61-2-Q	PFD LKR	12	0.100	7014	2	2	2	4695	3637	24
02-68-1-Q	BATTERY LKR	3	0.200	5364	1	1	1	4760	3687	57
CUI=AS	(Storerooms)									
3-47-1-Q	ENGRS STRM	5	0.400	694	6	6	6	1	1	1
3-52-1-Q	ELEC/ELEX STRM	5	0.400	1241	1	1	1	85	85	85
1-77-1-A	SODA LKR	2	0.010	16274	3	3	3	120	120	120
CUI=C	(Ship Control, Communication)									
3-52-0-C	ENGINEERING CONTROL CTR	8	0.300	1748	2	2	2	1748	1748	157
01-50-0-C	BUOY DECK CONTROL ROOM	8	0.300	607	4	4	6	607	607	99
02-52-0-C	PILOTHOUSE	8	0.300	2081	5	5	5	2081	2081	1021
CUI=EM	(Main Propulsion-Mechanical)									
3-6-0-E	BOW THRUSTER ROOM	13	0.200	15624	2	2	2	490	69	69
3-61-0-E	MAIN ENGINE ROOM	13	0.200	88260	3	3	3	9598	5050	1150
CUI=K	(Hazardous Material Storage)									
1-6-3-Q	PAINT LKR	3	0.200	16164	2	2	2	354	354	354
CUI=L1	(Senior Officer's Cabin)									
01-52-1-L	CO CABIN	9	0.300	1037	2	2	2	1037	1037	81
01-62-1-L	CO SR	10	0.100	967	2	2	2	967	967	13
CUI=L2	(Officer/CPO Quarters)									
01-52-2-L	CPO SR (1)	10	0.100	1184	2	2	2	256	256	256
01-61-2-L	CPO SR (1)	10	0.100	1020	2	2	2	256	256	256
CUI=L5	(Crews Berthing)									
1-79-1-L	ENLISTED SR (4)	10	0.100	1630	2	2	2	1630	1630	11
1-79-2-L	ENLISTED SR (3+1)	10	0.100	1484	2	2	2	1484	1484	13
01-68-2-L	PO SR (2+2)	10	0.100	1349	2	2	2	257	257	257
01-76-0-L	ENLISTED SR (4)	10	0.100	1606	2	2	2	256	256	256
01-76-2-L	ENLISTED SR (2+2)	10	0.100	1292	2	2	2	256	256	256
CUI=LL	(Wardroom/ Mess/ Lounge Area)									
1-61-0-L	MESS ROOM	9	0.200	2085	6	6	6	2085	2085	148
CUI=LP	(Passageway/Staircase/Vestibule)									
3-35-0-Q	PASSAGE	15	0.010	0	∞	∞	∞	0	0	0
1-52-0-L	PASSAGE	15	0.010	0	∞	∞	∞	0	0	0
1-52-1-L	COMPANIONWAY	14	0.010	0	∞	∞	∞	0	0	0
1-79-0-L	COMPANIONWAY	14	0.010	0	∞	∞	∞	0	0	0
1-79-01-L	PASSAGE	15	0.010	0	∞	∞	∞	0	0	0
01-55-0-L	PASSAGE	15	0.010	0	∞	∞	∞	0	0	0
01-61-1-L	COMPANIONWAY	14	0.010	0	∞	∞	∞	0	0	0
02-58-1-L	LADDER	14	0.010	0	∞	∞	∞	0	0	0

Table B.8.1 Fire Growth Models, Rates, and FRI Times (page 2 of 2)

Plan ID	Compartment Name	Growth Model	Alpha kW/sec.sq	Maximum Q KW	FRI Time (Min.) XRAY	YOKE	ZEBRA	Post-FRI Q (kW) XRAY	YOKE	ZEBRA
CUI=LW	**(Sanitary Spaces)**									
1-83-0-L	ENLISTED WR,WC&SH	16	0.001	5	∞	∞	∞	5	5	5
1-83-2-L	ENLISTED WR,WC&SH	16	0.001	5	∞	∞	∞	5	5	5
01-58-2-L	CPO WR,WC	16	0.001	5	∞	∞	∞	5	5	5
01-66-1-L	CO WR,WC SHR	16	0.001	5	∞	∞	∞	5	5	5
01-74-2-L	ENLISTED WR,WC&SH	16	0.001	5	∞	∞	∞	5	5	5
01-83-2-L	ENLISTED WR,WC&SH	16	0.001	5	∞	∞	∞	5	5	5
CUI=QA	**(Aux Machinery Spaces)**									
3-15-0-E	HYDRAULIC EQPT RM	13	0.200	30580	2	2	2	1033	119	119
3-42-1-Q	POTABLE WATER EQPT RM	13	0.200	16692	2	2	2	324	324	324
3-79-0-Q	PUMP ROOM	13	0.200	20324	2	2	2	7025	5310	70
3-88-0-E	PROPULSION THRUSTER RM	3	0.200	20181	3	3	3	5977	2030	156
CUI=QE	**(Emergency Aux Generator Rm)**									
02-68-2-E	EMERGENCY GEN RM	13	0.200	28857	2	2	2	3852	2983	34
CUI=QF	**(Fan Room)**									
02-52-0-V	VOID	16	0.001	24	∞	∞	∞	3	3	3
CUI=QG	**(Galley/ Pantry/ Scullery)**									
1-61-2-Q	GALLEY	13	0.200	17738	2	2	2	6957	4315	137
1-76-2-Q	SCULLERY	13	0.200	4910	1	1	1	4910	4167	13
CUI=QL	**(Laundry)**									
1-52-3-Q	CHANGE RM	12	0.100	1969	2	2	2	250	250	250
1-58-1-Q	LAUNDRY	12	0.100	1480	1	1	1	250	250	250
CUI=QO	**(Office Spaces)**									
1-52-2-Q	SHIP'S OFFICE	8	0.700	3923	1	1	1	668	99	99
1-57-2-Q	ENG OFFICE AND DC CENTRAL	8	0.700	3735	1	1	1	140	140	140
02-61-0-C	CHART ROOM	8	0.700	2490	1	1	1	2490	2490	1389
CUI=QS	**(Shops)**									
3-42-0-Q	MACHINE SHOP	7	0.010	1278	8	8	8	1278	1278	151
3-57-1-Q	ELEC SHOP	7	0.010	1025	5	5	5	399	399	399
1-6-1-Q	SERVICE LKR	13	0.200	2040	2	2	2	2040	2040	134
1-6-2-Q	ATON SHOP	13	0.200	3192	2	2	2	3192	3192	55
CUI=TU	**(Stacks/ Engine Uptakes)**									
1-70-1-Q	UPTAKE	13	0.200	3696	2	2	2	1	1	1
02-70-0-Q	STACK	13	0.200	2171	2	2	2	1385	1385	1385
CUI=V	**(Voids/ Cofferdams)**									
3-0-0-V	FOREPEAK	16	0.001	0	∞	∞	∞	0	0	0
3-15-0-V	VOID	16	0.001	0	∞	∞	∞	0	0	0
3-24-0-V	VOID	16	0.001	0	∞	∞	∞	0	0	0
3-35-0-V	VOID	16	0.001	0	∞	∞	∞	0	0	0
3-4-0-V	VOID	16	0.001	0	∞	∞	∞	0	0	0
3-42-0-V	VOID	16	0.001	0	∞	∞	∞	0	0	0
3-52-0-V	VOID	16	0.001	0	∞	∞	∞	0	0	0
3-6-0-V	VOID	16	0.001	0	∞	∞	∞	0	0	0
3-79-0-V	VOID	16	0.001	0	∞	∞	∞	0	0	0
3-88-0-V	VOID	16	0.001	0	∞	∞	∞	0	0	0
01-51-0-V	VOID	16	0.001	3	∞	∞	∞	1	1	1
CUI=W	**(Water Tank)**				∞	∞	∞			
3-35-1-W	BALLAST TANK	16	0.001	0	∞	∞	∞	0	0	0
3-35-2-W	BALLAST TANK	16	0.001	0	∞	∞	∞	0	0	0
3-81-1-W	GRAY WTR HOLDING TNK	16	0.001	0	∞	∞	∞	0	0	0
2-44-0-W	FRESH WATER TANK	16	0.001	0	∞	∞	∞	0	0	0

APPENDIX B REFERENCES

A. Marinette Marine Shipyard Drawing No. 7587-601-01, Rev. A, "General Arrangement, Inboard and Outboard Profiles"

B. Marinette Marine Shipyard Drawing No. 7587-801-13, Rev.B, "Midship Section and Typical Sections."

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Appendix C
COMPARTMENT/BARRIER FIRE SAFETY SUMMARIES

Each compartment in the ship is enclosed by bulkheads, decks and overheads which act as barriers to the spread of fire. To perform a fire safety analysis SAFE requires an extensive amount of input data required to analyze flame movement. This Appendix contains a summary of this input data organized by compartment and their associated barriers. The following information is summarized for each compartment:

- Geometry - Compartment Height, Deck Area, Cumulative Ventilation Opening Area and Average Ventilation Opening Height
- Fire Safety Objectives - Magnitude and Frequency of Acceptable Loss Ratings
- Fire Detection - Percent Time Monitored and Estimated Time to Detection In-Port and At-Sea
- Automatic Detection Systems - Quantity and Type
- Fixed and Manual Suppression - Quantity and Type Available to the Compartment
- Probability of Flame Termination - Matrix of Probabilities for I, A & M values given EB, TBar or DBar
- Fuel Loads - Cellulosic and Plastic Fuel Load Densities and Gallons of Flammable Liquids
- Fire Growth Model, Rates, and FRI Times - The Applicable Fire Growth Model, Pre-FRI Fire Growth Rate, Maximum Heat Release Rate, Post-FRI Heat Release Rate, and Full Room Involvement Times

The following information is summarized for each of the barriers in each compartment:

- Adjoining Compartment Names and IDs
- Area
- Materials (of construction)
- T-Adjust and D-Adjust Values
- Damage Control Classification

This input data can also be viewed sorted by type of information in Appendix B. The Safe User Manual, Reference D, defines the various codes used to describe the above characteristics.

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 2-24-0-AA CARGO HOLD

CUI: AA (Cargo Hold)

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o GEOMETRY

Compartment Height (ft):	11.0	Vent Area (sq in):	172
Deck Area (sq ft):	577.8	Avg. Vent Ht.(in):	132

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 3 (Full Room Involvement (FRI))
Frequency of Acceptable Loss: 1 per 13 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
2 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
1 PKP or Equivalent Dry Chem. 1 CO2
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	10	13	8
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	10	18	8
Frequency of Established Burning (fires/comp/year):			0.0001

o FUEL LOADS

Cellulosics(psf):	4.00	Plastics(psf):	0.30	Liquids(gals):	0
Fuel Stack Height(%):	6	Deck Area Occupied(%):	50		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 1 (Stacked Wood Pallets)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.1000
Maximum Heat Release Rate, MAXIMUM Q (kW): 106,769

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	3	3	3
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.3898	0.1815	0.0134

BARRIER FIRE SAFETY SUMMARY

Compartment: 2-24-0-AA CARGO HOLD

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness
3-35-1-W	BALLAST TANK	112.2	B09	B09	B09	-15	-9	
3-35-2-W	BALLAST TANK	110.0	B09	B09	B09	-15	-9	
3-15-0-E	HYDRAULIC EQPT RM	292.0	B09	B09	B09	-15	-9	DWT X
2-35-1-F	FUEL TANK	52.8	B09	B09	B09	-15	-9	
2-35-2-F	FUEL TANK	55.0	B09	B09	B09	-15	-9	
3-35-0-Q	PASSAGE	39.6	B09	B09	B09	-15	-9	DWT Z
3-15-0-V	VOID	29.2	B09	B09	B09	-15	-9	
(none)	(weather bulkhead)	203.8	B10	H03		0	0	
(none)	(weather bulkhead)	203.8	B10	H03		0	0	
3-24-0-V	VOID	577.8	D04			0	0	
(none)	(weather overhead)	577.8	D06			0	0	HL Y
								2 S Y

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 2-4-1-A CHAIN LKR

CUI: AG (Gear Locker)

---

o GEOMETRY

Compartment Height (ft):	16.5	Vent Area (sq in):	25
Deck Area (sq ft):	10.9	Avg. Vent Ht.(in):	198

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 3 (Full Room Involvement (FRI))
Frequency of Acceptable Loss: 1 per 15 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	0	0
Estimated Time to Detection (min):	16	16

AUTOMATIC DETECTION SYSTEMS:
None

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
1 PKP or Equivalent Dry Chem.
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	99	99	99
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	99	99	60
Frequency of Established Burning (fires/comp/year):			0.0010

o FUEL LOADS

Cellulosics(psf):	0.00	Plastics(psf):	2.30	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	10		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 16 (Very low density storage)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.0010
Maximum Heat Release Rate, MAXIMUM Q (kW): 3

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	999	999	999
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.0157	0.0157	0.0157

BARRIER FIRE SAFETY SUMMARY

Compartment: 2-4-1-A CHAIN LKR

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness
3-0-0-V	FOREPEAK	27.2	B09		B09	-15	-9	
3-0-0-V	FOREPEAK	25.6	B09		B09	-15	-9	
2-4-2-A	CHAIN LKR	25.6	B09		B09	-15	-9	
2-4-2-A	CHAIN LKR	27.2	B09		B09	-15	-9	
3-6-0-E	BOW THRUSTER ROOM	27.2	B09	B09	B09	-15	-9	
1-0-0-Q	BOATSWAIN STRM	28.9	B09		B09	-15	-9	
1-0-0-Q	BOATSWAIN STRM	27.2	B09		B09	-15	-9	
1-6-1-Q	SERVICE LKR	28.9	B09		B09	-15	-9	
3-4-0-V	VOID	10.9	D02			0	0	
(none)	(weather overhead)	10.9	D06			0	0	

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 2-4-2-A CHAIN LKR

CUI: AG (Gear Locker)

- GEOMETRY

Compartment Height (ft):	16.5	Vent Area (sq in):	25
Deck Area (sq ft):	10.9	Avg. Vent Ht.(in):	198

- FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 3 (Full Room Involvement (FRI))
Frequency of Acceptable Loss: 1 per 15 ship years

- FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	0	0
Estimated Time to Detection (min):	16	16

AUTOMATIC DETECTION SYSTEMS:
None

- FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
1 PKP or Equivalent Dry Chem.
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

- PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	99	99	99
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	99	99	60

Frequency of Established Burning (fires/comp/year): 0.0010

- FUEL LOADS

Cellulosics(psf):	0.00	Plastics(psf):	2.30	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	10		

- FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 16 (Very low density storage)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.0010
Maximum Heat Release Rate, MAXIMUM Q (kW): 3

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	999	999	999
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.0157	0.0157	0.0157

BARRIER FIRE SAFETY SUMMARY

Compartment: 2-4-2-A CHAIN LKR

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness
3-0-0-V	FOREPEAK	25.6	B09		B09	-15	-9	
3-0-0-V	FOREPEAK	27.2	B09		B09	-15	-9	
2-4-1-A	CHAIN LKR	25.6	B09		B09	-15	-9	
2-4-1-A	CHAIN LKR	27.2	B09		B09	-15	-9	
3-6-0-E	BOW THRUSTER ROOM	27.2	B09	B09	B09	-15	-9	
1-0-0-Q	BOATSWAIN STRM	27.2	B09		B09	-15	-9	
1-0-0-Q	BOATSWAIN STRM	28.9	B09		B09	-15	-9	
1-6-2-Q	ATON SHOP	28.9	B09		B10	-10	-8	
3-4-0-V	VOID	10.9	D02			0	0	
(none)	(weather overhead)	10.9	D06			0	0	

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 1-0-0-Q BOATSWAIN STRM

CUI: AG (Gear Locker)

---

o GEOMETRY

Compartment Height (ft):	8.5	Vent Area (sq in):	61
Deck Area (sq ft):	145.4	Avg. Vent Ht.(in):	102

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 3 (Full Room Involvement (FRI))
Frequency of Acceptable Loss: 1 per 15 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
1 PKP or Equivalent Dry Chem.
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	10	13	6
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	20	24	12

Frequency of Established Burning (fires/comp/year): 0.0010

o FUEL LOADS

Cellulosics(psf):	1.90	Plastics(psf):	1.10	Liquids(gals):	0
Fuel Stack Height(%):	60	Deck Area Occupied(%):	50		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 2 (Storage of stacked paper/lignocellulosics)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.0100
Maximum Heat Release Rate, MAXIMUM Q (kW): 30,344

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	5	5	5
Post-FRI Heat Release Rates, POST-FRI Q (kW):	1.3256	0.6256	0.0166

BARRIER FIRE SAFETY SUMMARY

Compartment: 1-0-0-Q BOATSWAIN STRM

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness	
2-4-1-A	CHAIN LKR	28.9	B09		B09	-15	-9		
2-4-1-A	CHAIN LKR	27.2	B09		B09	-15	-9		
2-4-2-A	CHAIN LKR	27.2	B09		B09	-15	-9		
2-4-2-A	CHAIN LKR	28.9	B09		B09	-15	-9		
1-6-1-Q	SERVICE LKR	28.9	B09		B09	-15	-9	DWT	Z
1-6-2-Q	ATON SHOP	64.6	B09		B10	-10	-8		
1-6-3-Q	PAINT LKR	35.7	B09		B09	-15	-9		
(none)	(weather bulkhead)	159.5	B09	B10		-10	-8		
(none)	(weather bulkhead)	159.5	B09	B10		-10	-8		
3-0-0-V	FOREPEAK	27.8	D04			0	0		
(none)	(weather overhead)	145.4	D06			0	0	S	Y

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 1-61-1-Q REPAIR LKR

CUI: AG (Gear Locker)

o GEOMETRY

Compartment Height (ft):	4.5	Vent Area (sq in):	246
Deck Area (sq ft):	38.0	Avg. Vent Ht.(in):	10

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 4 (Compartment Burnout (CBO))
Frequency of Acceptable Loss: 1 per 8 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
2 PKP or Equivalent Dry Chem.
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	10	13	6
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	20	24	12

Frequency of Established Burning (fires/comp/year): 0.0010

o FUEL LOADS

Cellulosics(psf):	4.40	Plastics(psf):	2.90	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	75		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 5 (Storage of unstacked cellulosics and plastics)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.1000
Maximum Heat Release Rate, MAXIMUM Q (kW): 1,744

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	1	1	1
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.1796	0.1796	0.1796

BARRIER FIRE SAFETY SUMMARY

Compartment: 1-61-1-Q REPAIR LKR

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness	
1-52-0-L	PASSAGE	15.3	B09		B09	-15	-9		
1-61-0-L	MESS ROOM	17.1	B09		B02	-15	-9		
1-61-0-L	MESS ROOM	45.0	B09		B02	-15	-9	DJ	NC
1-61-0-L	MESS ROOM	45.0	B09		B02	-15	-9		
3-61-0-E	MAIN ENGINE ROOM	38.0	D06			0	0		
1-61-0-L	MESS ROOM	38.0	D06			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 1-76-1-A CLEANING GEAR LOCKER

CUI: AG (Gear Locker)

- GEOMETRY

Compartment Height (ft):	8.5	Vent Area (sq in):	246
Deck Area (sq ft):	13.4	Avg. Vent Ht.(in):	10

- FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 4 (Compartment Burnout (CBO))
Frequency of Acceptable Loss: 1 per 8 ship years

- FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

- FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
2 PKP or Equivalent Dry Chem.
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

- PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	40	44	24
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	30	60	30

Frequency of Established Burning (fires/comp/year): 0.0010

- FUEL LOADS

Cellulosics(psf):	3.80	Plastics(psf):	2.50	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	75		

- FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 5 (Storage of unstacked cellulosics and plastics)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.1000
Maximum Heat Release Rate, MAXIMUM Q (kW): 531

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	1	1	1
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.5092	0.5092	0.5092

BARRIER FIRE SAFETY SUMMARY

Compartment: 1-76-1-A CLEANING GEAR LOCKER

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness	
1-61-0-L	MESS ROOM	23.8	B03		B02	0	0	DJ	NC
1-61-0-L	MESS ROOM	30.6	B03		B02	0	0		
1-77-1-A	SODA LKR	40.8	B03		B02	0	0		
(none)	(weather bulkhead)	23.8	B03	B10		-10	-8		
(none)	(weather bulkhead)	10.2	B03	B10		-10	-8		
3-61-0-E	MAIN ENGINE ROOM	12.3	D06			0	0		
(none)	(weather overhead)	13.4	D06			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 01-53-1-A CLEANING GEAR LOCKER

CUI: AG (Gear Locker)

- GEOMETRY

Compartment Height (ft):	5.0	Vent Area (sq in):	246
Deck Area (sq ft):	14.4	Avg. Vent Ht.(in):	10

- FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 4 (Compartment Burnout (CBO))
Frequency of Acceptable Loss: 1 per 8 ship years

- FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

- FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
2 PKP or Equivalent Dry Chem. 1 CO2
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

- PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	10	13	6
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	20	24	12

Frequency of Established Burning (fires/comp/year): 0.0010

- FUEL LOADS

Cellulosics(psf):	3.50	Plastics(psf):	2.30	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	75		

- FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 5 (Storage of unstacked cellulosics and plastics)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.1000
Maximum Heat Release Rate, MAXIMUM Q (kW): 525

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	1	1	1
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.4738	0.4738	0.4738

BARRIER FIRE SAFETY SUMMARY

Compartment: 01-53-1-A CLEANING GEAR LOCKER

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness	
01-52-1-L	CO CABIN	19.0	B09		B02	-15	-9		
01-55-0-L	PASSAGE	19.0	B03		B09	-15	-9		
01-55-0-L	PASSAGE	19.0	B03		B09	-15	-9		
01-55-0-L	PASSAGE	19.0	B03		B09	-15	-9	DJ	NC
1-52-0-L	PASSAGE	4.8	D04			0	0		
1-52-1-L	COMPANIONWAY	8.2	D04			0	0		
01-55-0-L	PASSAGE	14.4	D04			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 01-67-1-A LINEN LOCKER

CUI: AG (Gear Locker)

---

o GEOMETRY

Compartment Height (ft):	8.0	Vent Area (sq in):	246
Deck Area (sq ft):	6.8	Avg. Vent Ht.(in):	10

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 4 (Compartment Burnout (CBO))
Frequency of Acceptable Loss: 1 per 8 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
1 PKP or Equivalent Dry Chem.
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	10	13	6
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	20	24	12
Frequency of Established Burning (fires/comp/year):			0.0010

o FUEL LOADS

Cellulosics(psf):	14.60	Plastics(psf):	2.90	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	75		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 12 (Hanging cellulosics)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.1000
Maximum Heat Release Rate, MAXIMUM Q (kW): 1,758

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	1	1	1
Post-FRI Heat Release Rates, POST-FRI Q (kW):	1.0034	1.0034	1.0034

BARRIER FIRE SAFETY SUMMARY

Compartment: 01-67-1-A LINEN LOCKER

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs	and Names)	Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch	Readiness
01-55-0-L	PASSAGE	14.4	B02		B09	-15	-9		
01-55-0-L	PASSAGE	30.4	B02		B09	-15	-9	DJ	NC
01-61-1-L	COMPANIONWAY	30.4	B02		B02	0	0		
01-66-1-L	CO WR,WC SHR	14.4	B09		B03	-15	-9		
1-61-0-L	MESS ROOM	6.8	D04			0	0		
02-61-0-C	CHART ROOM	6.8	D04			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 01-70-1-Q BOAT LKR

CUI: AG (Gear Locker)

o GEOMETRY

Compartment Height (ft):	8.0	Vent Area (sq in):	36
Deck Area (sq ft):	12.5	Avg. Vent Ht.(in):	96

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 3 (Full Room Involvement (FRI))
Frequency of Acceptable Loss: 1 per 17 ship years

o FIRE DETECTION

FIRE DETECTION	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
2 PKP or Equivalent Dry Chem.
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	10	13	6
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	20	24	12

Frequency of Established Burning (fires/comp/year): 0.0010

o FUEL LOADS

Cellulosics(psf):	8.40	Plastics(psf):	8.70	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	75		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 5 (Storage of unstacked cellulosics and plastics)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.1000
Maximum Heat Release Rate, MAXIMUM Q (kW): 1,451

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	1	1	1
Post-FRI Heat Release Rates, POST-FRI Q (kW):	6.6017	6.6017	0.1107

BARRIER FIRE SAFETY SUMMARY

Compartment: 01-70-1-Q BOAT LKR

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness
1-70-1-Q	UPTAKE	40.0	B10		B09	-10	-8	
01-55-0-L	PASSAGE	33.6	B09		B09	-15	-9	
(none)	(weather bulkhead)	48.4	B09	B10		-10	-8	DWT Z
(none)	(weather bulkhead)	6.4	B09	B10		-10	-8	
1-61-0-L	MESS ROOM	12.5	D04			0	0	
(none)	(weather overhead)	12.5	D06			0	0	

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 01-83-4-Q TRASH LKR

CUI: AG (Gear Locker)

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o GEOMETRY

Compartment Height (ft):	8.0	Vent Area (sq in):	36
Deck Area (sq ft):	28.2	Avg. Vent Ht.(in):	96

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 4 (Compartment Burnout (CBO))
Frequency of Acceptable Loss: 1 per 8 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
1 PKP or Equivalent Dry Chem.
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	10	13	6
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	20	24	12

Frequency of Established Burning (fires/comp/year): 0.0010

o FUEL LOADS

Cellulosics(psf):	3.80	Plastics(psf):	0.30	Liquids(gals):	0
Fuel Stack Height(%):	65	Deck Area Occupied(%):	75		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 2 (Storage of stacked paper/lignocellulosics)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.0100
Maximum Heat Release Rate, MAXIMUM Q (kW): 9,641

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	3	3	3
Post-FRI Heat Release Rates, POST-FRI Q (kW):	9.4687	7.3344	0.0491

BARRIER FIRE SAFETY SUMMARY

Compartment: 01-83-4-Q TRASH LKR

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness
01-76-2-L	ENLISTED SR (2+2)	35.2	B09		B02	-15	-9	
01-83-2-L	ENLISTED WR,WC&SH	51.2	B09		B03	-15	-9	
(none)	(weather bulkhead)	51.2	B09	B10		-10	-8	
(none)	(weather bulkhead)	35.2	B09	B10		-10	-8	DWT Z
1-79-2-L	ENLISTED SR (3+1)	28.2	D04			0	0	
(none)	(weather overhead)	28.2	D06			0	0	

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 02-61-1-Q PFD LKR

CUI: AG (Gear Locker)

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o GEOMETRY

Compartment Height (ft):	8.0	Vent Area (sq in):	36
Deck Area (sq ft):	37.8	Avg. Vent Ht.(in):	96

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 3 (Full Room Involvement (FRI))
Frequency of Acceptable Loss: 1 per 17 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
2 CO2
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	0	0	0
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	10	12	6

Frequency of Established Burning (fires/comp/year): 0.0010

o FUEL LOADS

Cellulosics(psf):	14.30	Plastics(psf):	0.20	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	75		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 12 (Hanging cellulosics)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.1000
Maximum Heat Release Rate, MAXIMUM Q (kW): 7,043

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	2	2	2
Post-FRI Heat Release Rates, POST-FRI Q (kW):	7.0640	5.4717	0.0366

BARRIER FIRE SAFETY SUMMARY

Compartment: 02-61-1-Q PFD LKR

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness
02-52-0-V	VOID	16.0	B09		B10	-10	-8	
02-61-0-C	CHART ROOM	94.4	B09		B04	-15	-9	
02-52-0-C	PILOTHOUSE	9.6	B09		B02	-15	-9	
(none)	(weather bulkhead)	94.4	B09	B10		-10	-8	DWT Z
(none)	(weather bulkhead)	25.6	B09	B10		-10	-8	
01-62-1-L	CO SR	25.6	D06			0	0	
01-66-1-L	CO WR,WC SHR	12.2	D06			0	0	
(none)	(weather overhead)	37.8	D06			0	0	

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 02-61-2-Q PFD LKR

CUI: AG (Gear Locker)

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o GEOMETRY

Compartment Height (ft):	8.0	Vent Area (sq in):	36
Deck Area (sq ft):	40.1	Avg. Vent Ht.(in):	96

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 3 (Full Room Involvement (FRI))
Frequency of Acceptable Loss: 1 per 17 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
2 PKP or Equivalent Dry Chem. 2 CO_2
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	0	0	0
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	10	12	6

Frequency of Established Burning (fires/comp/year): 0.0010

o FUEL LOADS

Cellulosics(psf):	13.40	Plastics(psf):	0.20	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	75		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 12 (Hanging cellulosics)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.1000
Maximum Heat Release Rate, MAXIMUM Q (kW): 7,014

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	2	2	2
Post-FRI Heat Release Rates, POST-FRI Q (kW):	6.6588	5.1579	0.0345

BARRIER FIRE SAFETY SUMMARY

Compartment: 02-61-2-Q PFD LKR

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness
02-52-0-V	VOID	17.0	B09		B10	-10	-8	
02-61-0-C	CHART ROOM	94.4	B09		B04	-15	-9	
02-68-2-E	EMERGENCY GEN RM	27.2	B09		B10	-10	-8	
02-52-0-C	PILOTHOUSE	10.2	B09		B02	-15	-9	
(none)	(weather bulkhead)	94.4	B09	B10		-10	-8	DWT Z
01-55-0-L	PASSAGE	11.6	D06			0	0	
01-61-2-L	CPO SR (1)	28.6	D06			0	0	
(none)	(weather overhead)	40.1	D06			0	0	

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 02-68-1-Q BATTERY LKR

CUI: AG (Gear Locker)

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o GEOMETRY

Compartment Height (ft):	8.0	Vent Area (sq in):	84
Deck Area (sq ft):	12.2	Avg. Vent Ht.(in):	96

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 3 (Full Room Involvement (FRI))
Frequency of Acceptable Loss: 1 per 17 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
1 CO2
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	10	13	6
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	20	24	12

Frequency of Established Burning (fires/comp/year): 0.0010

o FUEL LOADS

Cellulosics(psf): 8.30 Plastics(psf): 8.90 Liquids(gals): 0
Fuel Stack Height(%): 75 Deck Area Occupied(%): 75

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 3 (Storage of stacked plastics in cartons)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.2000
Maximum Heat Release Rate, MAXIMUM Q (kW): 5,364

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	1	1	1
Post-FRI Heat Release Rates, POST-FRI Q (kW):	******	******	0.2646

BARRIER FIRE SAFETY SUMMARY

Compartment: 02-68-1-Q BATTERY LKR

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness
02-61-0-C	CHART ROOM	28.8	B09		B04	-15	-9	
02-68-2-E	EMERGENCY GEN RM	27.2	B09		B10	-10	-8	
02-70-0-Q	STACK	28.8	B09		B09	-15	-9	
(none)	(weather bulkhead)	27.2	B09	B10		-10	-8	DWT Z
01-55-0-L	PASSAGE	12.2	D04			0	0	
(none)	(weather overhead)	12.2	D06			0	0	

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 3-47-1-Q ENGRS STRM

CUI: AS (Storeroom)

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o GEOMETRY

Compartment Height (ft):	11.0	Vent Area (sq in):	0
Deck Area (sq ft):	110.1	Avg. Vent Ht.(in):	0

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 4 (Compartment Burnout (CBO))
Frequency of Acceptable Loss: 1 per 8 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
1 PKP or Equivalent Dry Chem. 1 CO2
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	40	44	24
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	30	60	30

Frequency of Established Burning (fires/comp/year): 0.0009

o FUEL LOADS

Cellulosics(psf):	2.00	Plastics(psf):	0.20	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	75		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 5 (Storage of unstacked cellulosics and plastics)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.4000
Maximum Heat Release Rate, MAXIMUM Q (kW): 694

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	6	6	6
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.0005	0.0005	0.0005

BARRIER FIRE SAFETY SUMMARY

Compartment: 3-47-1-Q ENGRS STRM

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness	
3-42-0-Q	MACHINE SHOP	74.8	B01		B01	-15	-9	DJ	NC
3-42-0-Q	MACHINE SHOP	9.1	B01		B09	-15	-9		
3-42-0-Q	MACHINE SHOP	5.6	B01		B09	-15	-9		
3-42-1-Q	POTABLE WATER EQPT RM	121.0	B09		B09	-15	-9		
2-44-0-W	FRESH WATER TANK	19.5	B10		B09	-10	-8		
2-44-0-W	FRESH WATER TANK	12.0	B09		B09	-15	-9		
3-52-1-Q	ELEC/ELEX STRM	149.6	B09	B09	B09	-15	-9		
(none)	(weather bulkhead)	92.4	B10	H03		0	0		
3-42-0-V	VOID	110.1	D04			0	0		
(none)	(weather overhead)	110.1	D06			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 3-52-1-Q ELEC/ELEX STRM

CUI: AS (Storeroom)

o GEOMETRY

Compartment Height (ft):	11.0	Vent Area (sq in):	48
Deck Area (sq ft):	105.1	Avg. Vent Ht.(in):	132

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 3 (Full Room Involvement (FRI))
Frequency of Acceptable Loss: 1 per 12 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
1 PKP or Equivalent Dry Chem. 1 CO2
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	40	44	24
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	30	60	30

Frequency of Established Burning (fires/comp/year): 0.0009

o FUEL LOADS

Cellulosics(psf): 2.10 Plastics(psf): 1.20 Liquids(gals): 0
Fuel Stack Height(%): NA Deck Area Occupied(%): 75

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 5 (Storage of unstacked cellulosics and plastics)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.4000
Maximum Heat Release Rate, MAXIMUM Q (kW): 1,241

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	1	1	1
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.0460	0.0460	0.0460

BARRIER FIRE SAFETY SUMMARY

Compartment: 3-52-1-Q ELEC/ELEX STRM

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness	
3-42-0-Q	MACHINE SHOP	6.6	B09	B09	B09	-15	-9		
3-47-1-Q	ENGRS STRM	149.6	B09	B09	B09	-15	-9		
3-52-0-C	ENGINEERING CONTROL CENT	81.4	B09		B04	-15	-9		
3-57-1-Q	ELEC SHOP	156.2	B01		B01	0	0	DJ	NC
(none)	(weather bulkhead)	81.4	B10	H03		0	0		
3-52-0-V	VOID	105.1	D06			0	0		
1-52-3-Q	CHANGE RM	99.2	D04			0	0		
(none)	(weather overhead)	5.9	D06			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 1-77-1-A   SODA LKR

CUI: AS (Storeroom)

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o GEOMETRY

Compartment Height (ft):	8.5	Vent Area (sq in):	246
Deck Area (sq ft):	14.4	Avg. Vent Ht.(in):	10

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 4 (Compartment Burnout (CBO))
Frequency of Acceptable Loss: 1 per 8 ship years

o FIRE DETECTION

FIRE DETECTION	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
2 PKP or Equivalent Dry Chem.
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	40	44	24
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	30	60	30

Frequency of Established Burning (fires/comp/year): 0.0009

o FUEL LOADS

Cellulosics(psf):	7.10	Plastics(psf):	1.30	Liquids(gals):	0
Fuel Stack Height(%):	95	Deck Area Occupied(%):	75		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 2 (Storage of stacked paper/lignocellulosics)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.0100
Maximum Heat Release Rate, MAXIMUM Q (kW): 16,274

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	3	3	3
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.4738	0.4738	0.4738

BARRIER FIRE SAFETY SUMMARY

Compartment: 1-77-1-A SODA LKR

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness	
1-61-0-L	MESS ROOM	25.5	B02		B02	0	0	DJ	NC
1-76-1-A	CLEANING GEAR LOCKER	40.8	B02		B03	0	0		
1-79-1-L	ENLISTED SR (4)	27.2	B09		B09	-15	-9		
(none)	(weather bulkhead)	25.5	B09	B10		-10	-8		
(none)	(weather bulkhead)	13.6	B09	B10		-10	-8		
3-61-0-E	MAIN ENGINE ROOM	13.2	D06			0	0		
(none)	(weather overhead)	14.4	D06			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 3-52-0-C ENGINEERING CONTROL CENTER

CUI: C (Ship Control/Communications)

o GEOMETRY

Compartment Height (ft):	11.0	Vent Area (sq in):	342
Deck Area (sq ft):	310.8	Avg. Vent Ht.(in):	71

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 2 (Established Burning (EB))
Frequency of Acceptable Loss: 1 per 24 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
1 PKP or Equivalent Dry Chem. 1 CO2
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	50	55	30
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	40	44	24

Frequency of Established Burning (fires/comp/year): 0.0012

o FUEL LOADS

Cellulosics(psf):	4.10	Plastics(psf):	0.20	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	25		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 8 (Office spaces)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.3000
Maximum Heat Release Rate, MAXIMUM Q (kW): 1,748

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	2	2	2
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.3199	0.3199	0.0288

BARRIER FIRE SAFETY SUMMARY

Compartment: 3-52-0-C ENGINEERING CONTROL CENTER

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs	and Names)	Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness	
3-61-0-E	MAIN ENGINE ROOM	231.0	B04	B09	B10	-10	-8	DWT	Z
3-42-0-Q	MACHINE SHOP	231.0	B04	B09	B04	-15	-9	DWT	Z
3-52-1-Q	ELEC/ELEX STRM	81.4	B04		B09	-15	-9		
3-57-1-Q	ELEC SHOP	81.4	B04		B09	-15	-9	DJ	NC
(none)	(weather bulkhead)	162.8	B04	H03		0	0		
3-52-0-V	VOID	310.8	D06			0	0		
1-52-0-L	PASSAGE	63.7	D04			0	0		
1-52-1-L	COMPANIONWAY	34.0	D04			0	0	HL	Z
1-52-2-Q	SHIP'S OFFICE	100.6	D04			0	0	S	Y
1-57-2-Q	ENG OFFICE AND DC CENTRA	100.6	D04			0	0		
(none)	(weather overhead)	11.9	D06			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 01-50-0-C BUOY DECK CONTROL ROOM

CUI: C (Ship Control/Communications)

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o GEOMETRY

Compartment Height (ft):	9.0	Vent Area (sq in):	294
Deck Area (sq ft):	90.0	Avg. Vent Ht.(in):	43

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 2 (Established Burning (EB))
Frequency of Acceptable Loss: 1 per 22 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
2 PKP or Equivalent Dry Chem. 1 CO2
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	70	77	42
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	40	44	24

Frequency of Established Burning (fires/comp/year): 0.0012

o FUEL LOADS

Cellulosics(psf): 4.20 Plastics(psf): 0.60 Liquids(gals): 0
Fuel Stack Height(%): NA Deck Area Occupied(%): 25

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 8 (Office spaces)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.3000
Maximum Heat Release Rate, MAXIMUM Q (kW): 607

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	4	4	6
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.3836	0.3836	0.0626

BARRIER FIRE SAFETY SUMMARY

Compartment: 01-50-0-C BUOY DECK CONTROL ROOM

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness	
02-52-0-V	VOID	24.0	B10		B02	-10	-8		
02-52-0-V	VOID	50.0	B02		B10	-10	-8		
02-52-0-V	VOID	24.0	B02		B10	-10	-8		
01-52-1-L	CO CABIN	19.2	B02		B02	0	0		
01-52-1-L	CO CABIN	4.8	B02		B02	0	0		
01-52-2-L	CPO SR (1)	19.2	B02		B02	0	0		
01-55-0-L	PASSAGE	35.2	B02		B09	-15	-9	DJ	NC
(none)	(weather bulkhead)	90.0	B02	B10		-10	-8		
(none)	(weather bulkhead)	37.8	B02	B10		-10	-8	DWT	Z
(none)	(weather bulkhead)	37.8	B02	B10		-10	-8	DWT	Z
01-51-0-V	VOID	90.0	D06			0	0		
02-52-0-C	PILOTHOUSE	48.0	D06			0	0		
(none)	(weather overhead)	42.0	D06			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 02-52-0-C PILOTHOUSE

CUI: C (Ship Control/Communications)

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o GEOMETRY

Compartment Height (ft):	8.0	Vent Area (sq in):	192
Deck Area (sq ft):	416.2	Avg. Vent Ht.(in):	4

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 2 (Established Burning (EB))
Frequency of Acceptable Loss: 1 per 26 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
1 PKP or Equivalent Dry Chem. 1 CO2
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	50	55	30
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	40	44	24

Frequency of Established Burning (fires/comp/year): 0.0012

o FUEL LOADS

Cellulosics(psf):	3.80	Plastics(psf):	0.10	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	25		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 8 (Office spaces)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.3000
Maximum Heat Release Rate, MAXIMUM Q (kW): 2,081

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	5	5	5
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.2844	0.2844	0.1395

BARRIER FIRE SAFETY SUMMARY

Compartment: 02-52-0-C PILOTHOUSE

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs	and Names)	Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness
02-58-1-L	LADDER	15.0	B02		B02	0	0	
02-58-1-L	LADDER	11.4	B02		B02	0	0	
02-58-1-L	LADDER	15.0	B02		B02	0	0	
02-61-0-C	CHART ROOM	9.0	B02		B02	0	0	DO O
02-61-0-C	CHART ROOM	19.8	B02		B02	0	0	
02-61-1-Q	PFD LKR	9.6	B02		B09	-15	-9	
02-61-2-Q	PFD LKR	10.2	B02		B09	-15	-9	
(none)	(weather bulkhead)	78.4	B02	B10		-10	-8	
(none)	(weather bulkhead)	57.6	B02	B10		-10	-8	
(none)	(weather bulkhead)	40.0	B02	B10		-10	-8	DWT Z
(none)	(weather bulkhead)	40.0	B02	B10		-10	-8	DWT Z
(none)	(weather bulkhead)	56.0	B02	B10		-10	-8	
(none)	(weather bulkhead)	78.4	B02	B10		-10	-8	
(none)	(weather bulkhead)	273.6	B02	B10		-10	-8	
(none)	(weather bulkhead)	19.0	B02	B10		-10	-8	
(none)	(weather bulkhead)	50.0	B02	B10		-10	-8	
(none)	(weather bulkhead)	31.0	B02	B10		-10	-8	
01-50-0-C	BUOY DECK CONTROL ROOM	48.0	D06			0	0	
02-52-0-V	VOID	283.6	D06			0	0	
02-58-1-L	LADDER	29.2	D06			0	0	
02-58-1-L	LADDER	19.0	D06			0	0	
(none)	(weather overhead)	435.2	D06			0	0	

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 3-61-0-E MAIN ENGINE ROOM

CUI: EM (Main Propulsion - Mechanical)

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o GEOMETRY

Compartment Height (ft):	14.5	Vent Area (sq in):	1496
Deck Area (sq ft):	1063.0	Avg. Vent Ht.(in):	174

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 2 (Established Burning (EB))
Frequency of Acceptable Loss: 1 per 26 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
3 Smoke — 4 Flame

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
1 CO_2 Total Flooding — 1 AFFF Sprinkler

MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
2 PKP or Equivalent Dry Chem. — 2 CO_2
Hose Reels:
3 AFFF
Fire Main Stations:
3 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	40	48	44
By Fixed Suppression Systems (%):	90	99	99
By Manual Suppression Equipment (%):	20	24	22

Frequency of Established Burning (fires/comp/year): 0.0272

o FUEL LOADS

Cellulosics(psf):	0.40	Plastics(psf):	0.30	Liquids(gals):	60
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	75		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 13 (Greasy, sooty spaces)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.2000
Maximum Heat Release Rate, MAXIMUM Q (kW): 88,260

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	3	3	3
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.5135	0.2702	0.0615

BARRIER FIRE SAFETY SUMMARY

Compartment: 3-61-0-E MAIN ENGINE ROOM

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch	Readiness
3-52-0-V	VOID	123.2	B09	B09	B09	-15	-9		
3-74-0-F	OILY WTR TNK	22.5	B10		B09	-10	-8		
3-74-0-F	OILY WTR TNK	41.4	B10		B09	-10	-8		
3-74-0-F	OILY WTR TNK	22.5	B10		B09	-10	-8		
3-77-0-F	WASTE OIL TANK	19.8	B10		B09	-10	-8		
3-77-0-F	WASTE OIL TANK	19.8	B10		B09	-10	-8		
3-79-0-V	VOID	25.2	B09	B09	B09	-15	-9		
3-79-0-V	VOID	25.2	B09	B09	B09	-15	-9		
3-79-1-F	FUEL SERVICE TANK	33.3	B09	B09	B09	0	0		
3-79-2-F	FUEL SERVICE TANK	33.3	B09	B09	B09	-15	-9		
3-52-0-C	ENGINEERING CONTROL CENT	231.0	B10	B09	B04	-10	-8	DWT	Z
3-57-1-Q	ELEC SHOP	156.2	B10	B09	B09	-10	-8		
3-79-0-Q	PUMP ROOM	281.6	B10	B09	B09	-10	-8	DWT	Z
(none)	(weather bulkhead)	135.9	B09	H03		0	0		
(none)	(weather bulkhead)	135.9	B09	H03		0	0		
(none)	(weather bulkhead)	302.0	B10	H03		0	0		
(none)	(weather bulkhead)	302.0	B10	H03		0	0		
3-74-0-F	OILY WTR TNK	46.0	D04			0	0		
3-77-0-F	WASTE OIL TANK	40.5	D04			0	0		
1-61-0-L	MESS ROOM	529.4	D06			0	0	S	Y
1-61-1-Q	REPAIR LKR	38.0	D06			0	0		
1-61-2-Q	GALLEY	286.1	D06			0	0	S	Y
1-70-1-Q	UPTAKE	66.0	D00			0	0		
1-76-1-A	CLEANING GEAR LOCKER	12.3	D06			0	0		
1-76-2-Q	SCULLERY	74.4	D06			0	0		
1-77-1-A	SODA LKR	13.2	D06			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 3-6-0-E BOW THRUSTER ROOM

CUI: EM (Main Propulsion - Mechanical)

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o GEOMETRY

Compartment Height (ft):	9.0	Vent Area (sq in):	61
Deck Area (sq ft):	279.0	Avg. Vent Ht.(in):	108

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 2 (Established Burning (EB))
Frequency of Acceptable Loss: 1 per 24 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
1 AFFF Sprinkler
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
1 CO2
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	70	77	42
By Fixed Suppression Systems (%):	25	28	23
By Manual Suppression Equipment (%):	40	50	24

Frequency of Established Burning (fires/comp/year): 0.0272

o FUEL LOADS

Cellulosics(psf):	0.60	Plastics(psf):	0.40	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	50		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 13 (Greasy, sooty spaces)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.2000
Maximum Heat Release Rate, MAXIMUM Q (kW): 15,624

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	2	2	2
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.0999	0.0141	0.0141

BARRIER FIRE SAFETY SUMMARY

Compartment: 3-6-0-E BOW THRUSTER ROOM

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs	and Names)	Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness
3-0-0-V	FOREPEAK	23.8	B09	B09	B09	-15	-9	
3-0-0-V	FOREPEAK	23.8	B09	B09	B09	-15	-9	
2-4-1-A	CHAIN LKR	27.2	B09	B09	B09	-15	-9	
2-4-2-A	CHAIN LKR	27.2	B09	B09	B09	-15	-9	
3-15-0-E	HYDRAULIC EQPT RM	223.2	B09	B09	B09	-15	-9	DWT X
3-4-0-V	VOID	12.4	B09	B09	B09	-15	-9	
(none)	(weather bulkhead)	146.1	B10	H03		0	0	
(none)	(weather bulkhead)	146.1	B10	H03		0	0	
3-6-0-V	VOID	279.0	D04			0	0	
1-6-1-Q	SERVICE LKR	101.6	D04			0	0	
1-6-2-Q	ATON SHOP	139.5	D06			0	0	HWS Y
1-6-3-Q	PAINT LKR	37.9	D04			0	0	

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 1-6-3-Q PAINT LKR

CUI: K (Hazardous Material Storage)

o GEOMETRY

Compartment Height (ft):	8.5	Vent Area (sq in):	307
Deck Area (sq ft):	97.5	Avg. Vent Ht.(in):	56

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 1 (No Established Burning (No EB))
Frequency of Acceptable Loss: 1 per 30 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
1 CO2 Total Flooding
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
2 PKP or Equivalent Dry Chem. 1 CO2
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	10	25	10
By Fixed Suppression Systems (%):	45	50	40
By Manual Suppression Equipment (%):	10	15	5

Frequency of Established Burning (fires/comp/year): 0.0013

o FUEL LOADS

Cellulosics(psf):	0.20	Plastics(psf):	0.20	Liquids(gals):	38
Fuel Stack Height(%):	95	Deck Area Occupied(%):	75		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 3 (Storage of stacked plastics in cartons)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.2000
Maximum Heat Release Rate, MAXIMUM Q (kW): 16,164

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	2	2	2
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.2067	0.2067	0.2067

BARRIER FIRE SAFETY SUMMARY

Compartment: 1-6-3-Q PAINT LKR

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness	
1-0-0-Q	BOATSWAIN STRM	35.7	B09		B09	-15	-9		
1-6-1-Q	SERVICE LKR	127.5	B09		B09	-15	-9	DJ	NC
(none)	(weather bulkhead)	133.4	B09	B10		-10	-8		
(none)	(weather bulkhead)	74.8	B09	B10		-10	-8		
3-6-0-E	BOW THRUSTER ROOM	37.9	D04			0	0		
(none)	(weather overhead)	97.5	D06			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 01-52-1-L CO CABIN

CUI: L1 (Senior Officer's Cabin)

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o GEOMETRY

Compartment Height (ft):	8.0	Vent Area (sq in):	417
Deck Area (sq ft):	148.2	Avg. Vent Ht.(in):	53

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 3 (Full Room Involvement (FRI))
Frequency of Acceptable Loss: 1 per 9 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
3 PKP or Equivalent Dry Chem.
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	20	24	10
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	30	39	18

Frequency of Established Burning (fires/comp/year): 0.0008

o FUEL LOADS

Cellulosics(psf):	3.60	Plastics(psf):	1.00	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	25		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 9 (Lounge spaces)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.3000
Maximum Heat Release Rate, MAXIMUM Q (kW): 1,037

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	2	2	2
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.3980	0.3980	0.1037

BARRIER FIRE SAFETY SUMMARY

Compartment: 01-52-1-L CO CABIN

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness	
01-51-0-V	VOID	4.8	B02		B10	-10	-8		
01-51-0-V	VOID	19.2	B02		B10	-10	-8		
01-53-1-A	CLEANING GEAR LOCKER	19.0	B02		B09	-15	-9		
01-55-0-L	PASSAGE	22.4	B02		B09	-15	-9		
01-55-0-L	PASSAGE	27.2	B02		B09	-15	-9	DJ	NC
01-55-0-L	PASSAGE	11.4	B02		B09	-15	-9		
01-62-1-L	CO SR	83.2	B02		B02	0	0	DJ	NO
01-50-0-C	BUOY DECK CONTROL ROOM	19.2	B02		B02	0	0		
01-50-0-C	BUOY DECK CONTROL ROOM	4.8	B02		B02	0	0		
(none)	(weather bulkhead)	118.4	B02	B10		-10	-8		
(none)	(weather bulkhead)	73.6	B02	B10		-10	-8		
1-52-3-Q	CHANGE RM	102.1	D04			0	0		
1-58-1-Q	LAUNDRY	46.1	D04			0	0		
02-52-0-V	VOID	148.2	D06			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 01-62-1-L CO SR

CUI: L1 (Senior Officer's Cabin)

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o GEOMETRY

Compartment Height (ft):	8.0	Vent Area (sq in):	96
Deck Area (sq ft):	83.2	Avg. Vent Ht.(in):	4

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 3 (Full Room Involvement (FRI))
Frequency of Acceptable Loss: 1 per 9 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
3 PKP or Equivalent Dry Chem.
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	20	24	10
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	30	39	18

Frequency of Established Burning (fires/comp/year): 0.0008

o FUEL LOADS

Cellulosics(psf): 4.80 Plastics(psf): 0.70 Liquids(gals): 0
Fuel Stack Height(%): NA Deck Area Occupied(%): 50

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 10 (Berthing areas)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.1000
Maximum Heat Release Rate, MAXIMUM Q (kW): 967

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	2	2	2
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.6610	0.6610	0.0091

BARRIER FIRE SAFETY SUMMARY

Compartment: 01-62-1-L CO SR

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness	
01-52-1-L	CO CABIN	83.2	B02		B02	0	0	DJ	NO
01-61-1-L	COMPANIONWAY	64.0	B02		B09	-15	-9		
01-66-1-L	CO WR,WC SHR	83.2	B02		B09	-15	-9	DJ	NO
(none)	(weather bulkhead)	64.0	B02	B10		-10	-8		
1-61-0-L	MESS ROOM	83.2	D04			0	0		
02-61-0-C	CHART ROOM	24.0	D04			0	0		
02-61-1-Q	PFD LKR	25.6	D06			0	0		
(none)	(weather overhead)	33.6	D06			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 01-52-2-L CPO SR (1)

CUI: L2 (Officer/CPO Quarters)

o GEOMETRY

Compartment Height (ft):	8.0	Vent Area (sq in):	588
Deck Area (sq ft):	90.2	Avg. Vent Ht.(in):	8

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 3 (Full Room Involvement (FRI))
Frequency of Acceptable Loss: 1 per 9 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
3 PKP or Equivalent Dry Chem.
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	40	44	24
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	30	48	21
Frequency of Established Burning (fires/comp/year):			0.0008

o FUEL LOADS

Cellulosics(psf):	5.20	Plastics(psf):	0.90	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	50		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 10 (Berthing areas)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.1000
Maximum Heat Release Rate, MAXIMUM Q (kW): 1,184

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	2	2	2
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.1617	0.1617	0.1617

BARRIER FIRE SAFETY SUMMARY

Compartment: 01-52-2-L CPO SR (1)

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness	
01-51-0-V	VOID	19.2	B02		B10	-10	-8		
01-55-0-L	PASSAGE	40.0	B02		B09	-15	-9	DJ	NC
01-58-2-L	CPO WR,WC	73.6	B02		B09	-15	-9	DJ	NC
01-50-0-C	BUOY DECK CONTROL ROOM	19.2	B02		B02	0	0		
(none)	(weather bulkhead)	73.6	B02	B10		-10	-8		
(none)	(weather bulkhead)	78.4	B02	B10		-10	-8		
1-52-2-Q	SHIP'S OFFICE	68.1	D04			0	0		
1-57-2-Q	ENG OFFICE AND DC CENTRA	22.1	D04			0	0		
02-52-0-V	VOID	90.2	D06			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 01-61-2-L CPO SR (1)

CUI: L2 (Officer/CPO Quarters)

o GEOMETRY

Compartment Height (ft):	8.0	Vent Area (sq in):	588
Deck Area (sq ft):	90.7	Avg. Vent Ht.(in):	8

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 3 (Full Room Involvement (FRI))
Frequency of Acceptable Loss: 1 per 9 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
3 PKP or Equivalent Dry Chem.
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	40	44	24
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	30	48	21

Frequency of Established Burning (fires/comp/year): 0.0008

o FUEL LOADS

Cellulosics(psf):	4.20	Plastics(psf):	0.90	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	50		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 10 (Berthing areas)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.1000
Maximum Heat Release Rate, MAXIMUM Q (kW): 1,020

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	2	2	2
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.1608	0.1608	0.1608

BARRIER FIRE SAFETY SUMMARY

Compartment: 01-61-2-L CPO SR (1)

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness	
01-55-0-L	PASSAGE	86.4	B02		B09	-15	-9		
01-55-0-L	PASSAGE	67.2	B02		B09	-15	-9	DJ	NC
01-58-2-L	CPO WR,WC	86.4	B02		B09	-15	-9	DJ	NC
(none)	(weather bulkhead)	67.2	B02	B10		-10	-8		
1-61-0-L	MESS ROOM	8.4	D04			0	0		
1-61-2-Q	GALLEY	82.3	D04			0	0		
02-61-0-C	CHART ROOM	26.9	D04			0	0		
02-61-2-Q	PFD LKR	28.6	D06			0	0		
(none)	(weather overhead)	35.2	D06			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 1-79-1-L ENLISTED SR (4)

CUI: L5 (Crews Berthing)

- GEOMETRY

Compartment Height (ft):	8.5	Vent Area (sq in):	96
Deck Area (sq ft):	140.2	Avg. Vent Ht.(in):	4

- FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 3 (Full Room Involvement (FRI))
Frequency of Acceptable Loss: 1 per 9 ship years

- FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

- FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
2 PKP or Equivalent Dry Chem.
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

- PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	50	50	30
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	20	40	18

Frequency of Established Burning (fires/comp/year): 0.0008

- FUEL LOADS

Cellulosics(psf):	5.60	Plastics(psf):	0.30	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	50		

- FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 10 (Berthing areas)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.1000
Maximum Heat Release Rate, MAXIMUM Q (kW): 1,630

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	2	2	2
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.6612	0.6612	0.0045

BARRIER FIRE SAFETY SUMMARY

Compartment: 1-79-1-L ENLISTED SR (4)

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness	
3-88-0-E	PROPULSION THRUSTER RM	81.6	B10		B09	-10	-8		
1-61-0-L	MESS ROOM	54.4	B09		B02	-15	-9		
1-77-1-A	SODA LKR	27.2	B09		B09	-15	-9		
1-79-0-L	COMPANIONWAY	27.2	B02		B09	-15	-9		
1-79-01-L	PASSAGE	27.2	B02		B02	0	0	DJ	NO
1-83-0-L	ENLISTED WR,WC&SH	69.7	B02		B03	0	0	DJ	NO
(none)	(weather bulkhead)	124.1	B02	B10		-10	-8		
3-79-0-Q	PUMP ROOM	140.2	D04			0	0		
(none)	(weather overhead)	140.2	D06			0	0	S	Y

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 1-79-2-L ENLISTED SR (3+1)

CUI: L5 (Crews Berthing)

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o GEOMETRY

Compartment Height (ft):	8.5	Vent Area (sq in):	96
Deck Area (sq ft):	125.6	Avg. Vent Ht.(in):	4

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 3 (Full Room Involvement (FRI))
Frequency of Acceptable Loss: 1 per 9 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
2 PKP or Equivalent Dry Chem.
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	50	50	30
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	20	40	18

Frequency of Established Burning (fires/comp/year): 0.0008

o FUEL LOADS

Cellulosics(psf):	5.70	Plastics(psf):	0.30	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	50		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 10 (Berthing areas)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.1000
Maximum Heat Release Rate, MAXIMUM Q (kW): 1,484

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	2	2	2
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.6720	0.6720	0.0060

BARRIER FIRE SAFETY SUMMARY

Compartment: 1-79-2-L ENLISTED SR (3+1)

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness	
3-88-0-E	PROPULSION THRUSTER RM	73.1	B10		B09	-10	-8		
1-76-2-Q	SCULLERY	73.1	B09		B03	-15	-9		
1-79-01-L	PASSAGE	54.4	B02		B02	0	0	DJ	NO
1-83-2-L	ENLISTED WR,WC&SH	69.7	B02		B03	0	0	DJ	NO
(none)	(weather bulkhead)	124.1	B02	B10		-10	-8		
3-79-0-Q	PUMP ROOM	125.6	D04			0	0		
01-76-2-L	ENLISTED SR (2+2)	34.3	D04			0	0		
01-83-2-L	ENLISTED WR,WC&SH	14.1	D04			0	0		
01-83-4-Q	TRASH LKR	28.2	D04			0	0		
(none)	(weather overhead)	49.0	D06			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 01-68-2-L PO SR (2+2)

CUI: L5 (Crews Berthing)

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o GEOMETRY

Compartment Height (ft):	8.0	Vent Area (sq in):	588
Deck Area (sq ft):	97.2	Avg. Vent Ht.(in):	8

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 3 (Full Room Involvement (FRI))
Frequency of Acceptable Loss: 1 per 9 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
3 PKP or Equivalent Dry Chem.
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	50	50	30
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	20	40	18

Frequency of Established Burning (fires/comp/year): 0.0008

o FUEL LOADS

Cellulosics(psf): 6.40 Plastics(psf): 0.50 Liquids(gals): 0
Fuel Stack Height(%): NA Deck Area Occupied(%): 50

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 10 (Berthing areas)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.1000
Maximum Heat Release Rate, MAXIMUM Q (kW): 1,349

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	2	2	2
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.1501	0.1501	0.1501

BARRIER FIRE SAFETY SUMMARY

Compartment: 01-68-2-L   PO SR (2+2)

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness	
01-55-0-L	PASSAGE	86.4	B02		B09	-15	-9	DJ	NC
01-55-0-L	PASSAGE	72.0	B02		B09	-15	-9		
01-74-2-L	ENLISTED WR,WC&SH	86.4	B02		B09	-15	-9	DJ	NC
(none)	(weather bulkhead)	72.0	B02	B10		-10	-8		
1-61-0-L	MESS ROOM	18.0	D04			0	0		
1-61-2-Q	GALLEY	79.2	D04			0	0		
02-68-2-E	EMERGENCY GEN RM	59.4	D06			0	0		
(none)	(weather overhead)	37.8	D06			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 01-76-0-L ENLISTED SR (4)

CUI: L5 (Crews Berthing)

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o GEOMETRY

Compartment Height (ft):	8.0	Vent Area (sq in):	588
Deck Area (sq ft):	140.4	Avg. Vent Ht.(in):	8

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 3 (Full Room Involvement (FRI))
Frequency of Acceptable Loss: 1 per 9 ship years

o FIRE DETECTION

FIRE DETECTION	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
3 PKP or Equivalent Dry Chem.
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	50	50	30
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	20	40	18

Frequency of Established Burning (fires/comp/year): 0.0008

o FUEL LOADS

Cellulosics(psf):	5.50	Plastics(psf):	0.30	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	50		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 10 (Berthing areas)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.1000
Maximum Heat Release Rate, MAXIMUM Q (kW): 1,606

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	2	2	2
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.1039	0.1039	0.1039

BARRIER FIRE SAFETY SUMMARY

Compartment: 01-76-0-L ENLISTED SR (4)

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness
1-70-1-Q	UPTAKE	52.8	B02		B10	-10	-8	
01-55-0-L	PASSAGE	27.2	B02		B09	-15	-9	
01-55-0-L	PASSAGE	27.2	B02		B09	-15	-9	DJ NC
01-76-2-L	ENLISTED SR (2+2)	54.4	B02		B09	-15	-9	
01-83-2-L	ENLISTED WR,WC&SH	17.6	B02		B09	-15	-9	
01-83-2-L	ENLISTED WR,WC&SH	51.2	B02		B09	-15	-9	DJ NC
(none)	(weather bulkhead)	132.8	B09	B10		-10	-8	
(none)	(weather bulkhead)	62.4	B02	B10		-10	-8	
1-61-0-L	MESS ROOM	38.4	D04			0	0	
1-79-0-L	COMPANIONWAY	32.0	D04			0	0	
1-79-01-L	PASSAGE	29.4	D04			0	0	
1-83-0-L	ENLISTED WR,WC&SH	37.4	D04			0	0	
1-83-2-L	ENLISTED WR,WC&SH	3.1	D04			0	0	
02-70-0-Q	STACK	5.8	D06			0	0	
(none)	(weather overhead)	134.6	D06			0	0	

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 01-76-2-L ENLISTED SR (2+2)

CUI: L5 (Crews Berthing)

---

o GEOMETRY

Compartment Height (ft):	8.0	Vent Area (sq in):	588
Deck Area (sq ft):	104.4	Avg. Vent Ht.(in):	8

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 3 (Full Room Involvement (FRI))
Frequency of Acceptable Loss: 1 per 9 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
3 PKP or Equivalent Dry Chem.
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	50	50	30
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	20	40	18

Frequency of Established Burning (fires/comp/year): 0.0008

o FUEL LOADS

Cellulosics(psf):	6.00	Plastics(psf):	0.30	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	50		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 10 (Berthing areas)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.1000
Maximum Heat Release Rate, MAXIMUM Q (kW): 1,292

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	2	2	2
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.1397	0.1397	0.1397

BARRIER FIRE SAFETY SUMMARY

Compartment: 01-76-2-L ENLISTED SR (2+2)

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs	and Names)	Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness	
01-55-0-L	PASSAGE	32.0	B09		B09	-15	-9	DJ	NC
01-74-2-L	ENLISTED WR,WC&SH	48.0	B02		B09	-15	-9	DJ	NC
01-74-2-L	ENLISTED WR,WC&SH	19.3	B02		B09	-15	-9		
01-74-2-L	ENLISTED WR,WC&SH	25.6	B02		B09	-15	-9		
01-76-0-L	ENLISTED SR (4)	54.4	B09		B02	-15	-9		
01-83-2-L	ENLISTED WR,WC&SH	51.2	B02		B09	-15	-9		
01-83-4-Q	TRASH LKR	35.2	B02		B09	-15	-9		
(none)	(weather bulkhead)	72.0	B02	B10		-10	-8		
1-61-0-L	MESS ROOM	5.6	D04			0	0		
1-76-2-Q	SCULLERY	42.6	D04			0	0		
1-79-0-L	COMPANIONWAY	3.2	D04			0	0		
1-79-01-L	PASSAGE	18.6	D04			0	0		
1-79-2-L	ENLISTED SR (3+1)	34.3	D04			0	0		
02-68-2-E	EMERGENCY GEN RM	9.8	D06			0	0		
(none)	(weather overhead)	94.6	D06			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 1-61-0-L MESS ROOM

CUI: LL (Wardroom/Mess/Lounge Areas)

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o GEOMETRY

Compartment Height (ft):	8.5	Vent Area (sq in):	1176
Deck Area (sq ft):	529.4	Avg. Vent Ht.(in):	8

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 2 (Established Burning (EB))
Frequency of Acceptable Loss: 1 per 22 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
2 PKP or Equivalent Dry Chem.
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	30	33	18
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	40	50	24

Frequency of Established Burning (fires/comp/year): 0.0008

o FUEL LOADS

Cellulosics(psf):	2.50	Plastics(psf):	0.50	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	50		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 9 (Lounge spaces)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.2000
Maximum Heat Release Rate, MAXIMUM Q (kW): 2,085

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	6	6	6
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.2240	0.2240	0.0159

BARRIER FIRE SAFETY SUMMARY

Compartment: 1-61-0-L MESS ROOM

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs	and Names)	Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness	
1-52-0-L	PASSAGE	27.2	B09		B09	-15	-9	DWT	Z
1-52-0-L	PASSAGE	13.6	B09		B09	-15	-9		
1-52-3-Q	CHANGE RM	28.9	B02		B09	-15	-9		
1-57-2-Q	ENG OFFICE AND DC CENTRA	10.2	B09		B09	-15	-9		
1-58-1-Q	LAUNDRY	81.6	B02		B09	-15	-9		
1-61-1-Q	REPAIR LKR	17.1	B02		B09	-15	-9		
1-61-1-Q	REPAIR LKR	45.0	B02		B09	-15	-9	DJ	NC
1-61-1-Q	REPAIR LKR	45.0	B02		B09	-15	-9		
1-61-2-Q	GALLEY	86.7	B09		B03	-15	-9	DJ	NC
1-61-2-Q	GALLEY	8.5	B09		B03	-15	-9		
1-61-2-Q	GALLEY	119.0	B09		B03	-15	-9	DJ	NO
1-70-1-Q	UPTAKE	85.0	B02		B10	-10	-8		
1-70-1-Q	UPTAKE	56.1	B02		B10	-10	-8		
1-70-1-Q	UPTAKE	85.0	B02		B10	-10	-8		
1-70-1-Q	UPTAKE	56.1	B02		B10	-10	-8		
1-76-1-A	CLEANING GEAR LOCKER	23.8	B02		B03	0	0	DJ	NC
1-76-1-A	CLEANING GEAR LOCKER	30.6	B02		B03	0	0		
1-76-2-Q	SCULLERY	8.5	B09		B03	-15	-9		
1-76-2-Q	SCULLERY	51.0	B09		B03	-15	-9	DJ	NO
1-77-1-A	SODA LKR	25.5	B02		B02	0	0	DJ	NC
1-79-0-L	COMPANIONWAY	95.2	B02		B09	-15	-9	DWT	Z
1-79-1-L	ENLISTED SR (4)	54.4	B02		B09	-15	-9		
(none)	(weather bulkhead)	207.4	B02	B10		-10	-8		
3-61-0-E	MAIN ENGINE ROOM	529.4	D06			0	0	S	Y
1-61-1-Q	REPAIR LKR	38.0	D06			0	0		
01-55-0-L	PASSAGE	139.0	D04			0	0		
01-61-1-L	COMPANIONWAY	38.0	D04			0	0	HL	Z
01-61-2-L	CPO SR (1)	8.4	D04			0	0		
01-62-1-L	CO SR	83.2	D04			0	0		
01-66-1-L	CO WR,WC SHR	39.5	D04			0	0		
01-67-1-A	LINEN LOCKER	6.8	D04			0	0		
01-68-2-L	PO SR (2+2)	18.0	D04			0	0		
01-70-1-Q	BOAT LKR	12.5	D04			0	0		
01-74-2-L	ENLISTED WR,WC&SH	7.2	D04			0	0		
01-76-0-L	ENLISTED SR (4)	38.4	D04			0	0		
01-76-2-L	ENLISTED SR (2+2)	5.6	D04			0	0		
(none)	(weather overhead)	170.8	D06			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 3-35-0-Q PASSAGE

CUI: LP (Passageway/Staircase/Vestibule)

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o GEOMETRY

Compartment Height (ft):	11.0	Vent Area (sq in):	32
Deck Area (sq ft):	41.8	Avg. Vent Ht.(in):	132

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 3 (Full Room Involvement (FRI))
Frequency of Acceptable Loss: 1 per 16 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
1 PKP or Equivalent Dry Chem.
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	99	99	90
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	80	88	72
Frequency of Established Burning (fires/comp/year):			0.0001

o FUEL LOADS

Cellulosics(psf):	1.30	Plastics(psf):	0.30	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	5		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 15 (Passageways)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.0100
Maximum Heat Release Rate, MAXIMUM Q (kW): 8

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	999	999	999
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.0109	0.0109	0.0109

BARRIER FIRE SAFETY SUMMARY

Compartment: 3-35-0-Q PASSAGE

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness
2-24-0-AA	CARGO HOLD	39.6	B09	B09	B09	-15	-9	DWT Z
2-35-1-F	FUEL TANK	127.6	B09		B09	-15	-9	
2-35-2-F	FUEL TANK	127.6	B09		B09	-15	-9	
3-42-0-Q	MACHINE SHOP	39.6	B09	B09	B09	-15	-9	DWT Z
3-35-0-V	VOID	23.8	D04			0	0	
3-39-0-F	FUEL OVERFLOW TNK	18.0	D04			0	0	
(none)	(weather overhead)	41.8	D06			0	0	

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 1-52-0-L PASSAGE

CUI: LP (Passageway/Staircase/Vestibule)

o GEOMETRY

Compartment Height (ft):	8.5	Vent Area (sq in):	834
Deck Area (sq ft):	63.7	Avg. Vent Ht.(in):	9

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 3 (Full Room Involvement (FRI))
Frequency of Acceptable Loss: 1 per 16 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
1 PKP or Equivalent Dry Chem.
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	99	99	90
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	80	88	72

Frequency of Established Burning (fires/comp/year): 0.0001

o FUEL LOADS

Cellulosics(psf): 3.60 Plastics(psf): 0.20 Liquids(gals): 0
Fuel Stack Height(%): NA Deck Area Occupied(%): 5

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 15 (Passageways)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.0100
Maximum Heat Release Rate, MAXIMUM Q (kW): 25

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	999	999	999
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.0223	0.0223	0.0223

BARRIER FIRE SAFETY SUMMARY

Compartment: 1-52-0-L PASSAGE

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs	and Names)	Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness	
1-52-1-L	COMPANIONWAY	28.9	B09		B02	-15	-9		
1-52-1-L	COMPANIONWAY	85.0	B09		B02	-15	-9	DJ	NO
1-52-2-Q	SHIP'S OFFICE	62.9	B09		B02	-15	-9	DJ	NC
1-57-2-Q	ENG OFFICE AND DC CENTRA	62.9	B09		B02	-15	-9	DJ	NC
1-58-1-Q	LAUNDRY	40.8	B09		B03	-15	-9	DJ	NC
1-61-0-L	MESS ROOM	27.2	B09		B09	-15	-9	DWT	Z
1-61-0-L	MESS ROOM	13.6	B09		B09	-15	-9		
1-61-1-Q	REPAIR LKR	15.3	B09		B09	-15	-9		
(none)	(weather bulkhead)	27.2	B09	B10		-10	-8	DWT	Z
3-52-0-C	ENGINEERING CONTROL CENT	63.7	D04			0	0		
01-51-0-V	VOID	15.4	D06			0	0		
01-53-1-A	CLEANING GEAR LOCKER	4.8	D04			0	0		
01-55-0-L	PASSAGE	43.6	D04			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 1-52-1-L COMPANIONWAY

CUI: LP (Passageway/Staircase/Vestibule)

o GEOMETRY

Compartment Height (ft):	8.5	Vent Area (sq in):	246
Deck Area (sq ft):	34.0	Avg. Vent Ht.(in):	10

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 3 (Full Room Involvement (FRI))
Frequency of Acceptable Loss: 1 per 16 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
4 PKP or Equivalent Dry Chem.
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	99	99	90
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	80	88	72

Frequency of Established Burning (fires/comp/year): 0.0001

o FUEL LOADS

Cellulosics(psf):	2.60	Plastics(psf):	0.20	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	5		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 14 (Stairways)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.0100
Maximum Heat Release Rate, MAXIMUM Q (kW): 14

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	999	999	999
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.0234	0.0234	0.0234

BARRIER FIRE SAFETY SUMMARY

Compartment: 1-52-1-L COMPANIONWAY

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness	
1-52-0-L	PASSAGE	28.9	B02		B09	-15	-9		
1-52-0-L	PASSAGE	85.0	B02		B09	-15	-9	DJ	NO
1-52-3-Q	CHANGE RM	85.0	B02		B09	-15	-9	DJ	NC
(none)	(weather bulkhead)	28.9	B02	B10		-10	-8		
3-52-0-C	ENGINEERING CONTROL CENT	34.0	D04			0	0	HL	Z
01-51-0-V	VOID	16.3	D06			0	0		
01-53-1-A	CLEANING GEAR LOCKER	8.2	D04			0	0		
01-55-0-L	PASSAGE	9.5	D04			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 1-79-0-L COMPANIONWAY

CUI: LP (Passageway/Staircase/Vestibule)

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o GEOMETRY

Compartment Height (ft):	8.5	Vent Area (sq in):	0
Deck Area (sq ft):	35.8	Avg. Vent Ht.(in):	0

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 3 (Full Room Involvement (FRI))
Frequency of Acceptable Loss: 1 per 16 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
2 PKP or Equivalent Dry Chem. 1 CO2
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	99	99	90
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	80	88	72

Frequency of Established Burning (fires/comp/year): 0.0001

o FUEL LOADS

Cellulosics(psf):	1.20	Plastics(psf):	0.20	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	5		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 14 (Stairways)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.0100
Maximum Heat Release Rate, MAXIMUM Q (kW): 8

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	999	999	999
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.0127	0.0127	0.0005

BARRIER FIRE SAFETY SUMMARY

Compartment: 1-79-0-L COMPANIONWAY

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness	
1-61-0-L	MESS ROOM	95.2	B09		B02	-15	-9	DWT	Z
1-79-01-L	PASSAGE	27.2	B09		B02	-15	-9	DJ	NO
1-79-01-L	PASSAGE	95.2	B09		B02	-15	-9		
1-79-1-L	ENLISTED SR (4)	27.2	B09		B02	-15	-9		
3-79-0-Q	PUMP ROOM	35.8	D04			0	0	HL	Z
01-76-0-L	ENLISTED SR (4)	32.0	D04			0	0		
01-76-2-L	ENLISTED SR (2+2)	3.2	D04			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 1-79-01-L PASSAGE

CUI: LP (Passageway/Staircase/Vestibule)

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o GEOMETRY

Compartment Height (ft):	8.5	Vent Area (sq in):	96
Deck Area (sq ft):	56.3	Avg. Vent Ht.(in):	4

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 3 (Full Room Involvement (FRI))
Frequency of Acceptable Loss: 1 per 16 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
2 PKP or Equivalent Dry Chem.
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	99	99	90
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	80	88	72

Frequency of Established Burning (fires/comp/year): 0.0001

o FUEL LOADS

Cellulosics(psf):	3.70	Plastics(psf):	0.20	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	5		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 15 (Passageways)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.0100
Maximum Heat Release Rate, MAXIMUM Q (kW): 23

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	999	999	999
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.0232	0.0232	0.0113

BARRIER FIRE SAFETY SUMMARY

Compartment: 1-79-01-L PASSAGE

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness	
1-76-2-Q	SCULLERY	27.2	B09		B03	-15	-9		
1-79-0-L	COMPANIONWAY	27.2	B02		B09	-15	-9	DJ	NO
1-79-0-L	COMPANIONWAY	95.2	B02		B09	-15	-9		
1-79-1-L	ENLISTED SR (4)	27.2	B02		B02	0	0	DJ	NO
1-79-2-L	ENLISTED SR (3+1)	54.4	B02		B02	0	0	DJ	NO
1-83-0-L	ENLISTED WR,WC&SH	62.9	B02		B03	0	0		
1-83-2-L	ENLISTED WR,WC&SH	59.5	B02		B03	0	0		
3-79-0-Q	PUMP ROOM	56.3	D04			0	0		
01-76-0-L	ENLISTED SR (4)	29.4	D04			0	0		
01-76-2-L	ENLISTED SR (2+2)	18.6	D04			0	0		
01-83-2-L	ENLISTED WR,WC&SH	7.7	D04			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 01-55-0-L PASSAGE

CUI: LP (Passageway/Staircase/Vestibule)

o GEOMETRY

Compartment Height (ft):	8.0	Vent Area (sq in):	3144
Deck Area (sq ft):	239.1	Avg. Vent Ht.(in):	9

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 3 (Full Room Involvement (FRI))
Frequency of Acceptable Loss: 1 per 16 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
2 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
2 PKP or Equivalent Dry Chem.
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	99	99	90
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	80	88	72

Frequency of Established Burning (fires/comp/year): 0.0001

o FUEL LOADS

Cellulosics(psf):	3.50	Plastics(psf):	0.10	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	5		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 15 (Passageways)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.0100
Maximum Heat Release Rate, MAXIMUM Q (kW): 88

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	999	999	999
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.0209	0.0209	0.0209

BARRIER FIRE SAFETY SUMMARY

Compartment: 01-55-0-L PASSAGE

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness	
1-70-1-Q	UPTAKE	80.0	B09		B10	-10	-8		
1-70-1-Q	UPTAKE	52.8	B09		B10	-10	-8		
01-51-0-V	VOID	35.2	B09		B10	-10	-8		
01-52-1-L	CO CABIN	22.4	B09		B02	-15	-9		
01-52-1-L	CO CABIN	27.2	B09		B02	-15	-9	DJ	NC
01-52-1-L	CO CABIN	11.4	B09		B02	-15	-9		
01-52-2-L	CPO SR (1)	40.0	B09		B02	-15	-9	DJ	NC
01-53-1-A	CLEANING GEAR LOCKER	19.0	B09		B03	-15	-9		
01-53-1-A	CLEANING GEAR LOCKER	19.0	B09		B03	-15	-9		
01-53-1-A	CLEANING GEAR LOCKER	19.0	B09		B03	-15	-9	DJ	NC
01-58-2-L	CPO WR,WC	14.4	B09		B03	-15	-9		
01-58-2-L	CPO WR,WC	12.8	B09		B03	-15	-9		
01-58-2-L	CPO WR,WC	25.6	B09		B03	-15	-9		
01-61-1-L	COMPANIONWAY	80.0	B09		B02	-15	-9	DJ	NC
01-61-1-L	COMPANIONWAY	30.4	B09		B02	-15	-9		
01-61-2-L	CPO SR (1)	86.4	B09		B02	-15	-9		
01-61-2-L	CPO SR (1)	67.2	B09		B02	-15	-9	DJ	NC
01-66-1-L	CO WR,WC SHR	56.0	B09		B03	-15	-9		
01-67-1-A	LINEN LOCKER	14.4	B09		B02	-15	-9		
01-67-1-A	LINEN LOCKER	30.4	B09		B02	-15	-9	DJ	NC
01-68-2-L	PO SR (2+2)	86.4	B09		B02	-15	-9	DJ	NC
01-68-2-L	PO SR (2+2)	72.0	B09		B02	-15	-9		
01-70-1-Q	BOAT LKR	33.6	B09		B09	-15	-9		
01-74-2-L	ENLISTED WR,WC&SH	30.4	B09		B03	-15	-9		
01-76-0-L	ENLISTED SR (4)	27.2	B09		B02	-15	-9		
01-76-0-L	ENLISTED SR (4)	27.2	B09		B02	-15	-9	DJ	NC
01-76-2-L	ENLISTED SR (2+2)	32.0	B09		B09	-15	-9	DJ	NC
01-50-0-C	BUOY DECK CONTROL ROOM	35.2	B09		B02	-15	-9	DJ	NC
(none)	(weather bulkhead)	27.2	B09	B10		-10	-8	DWT	Z
(none)	(weather bulkhead)	27.2	B09	B10		-10	-8	DWT	Z
1-52-0-L	PASSAGE	43.6	D04			0	0		
1-52-1-L	COMPANIONWAY	9.5	D04			0	0		
1-52-2-Q	SHIP'S OFFICE	4.7	D04			0	0		
1-57-2-Q	ENG OFFICE AND DC CENTRA	8.2	D04			0	0		
1-61-0-L	MESS ROOM	139.0	D04			0	0		
1-61-2-Q	GALLEY	31.7	D04			0	0		
01-53-1-A	CLEANING GEAR LOCKER	14.4	D04			0	0		
02-52-0-V	VOID	34.7	D06			0	0		
02-58-1-L	LADDER	48.2	D04			0	0		
02-61-0-C	CHART ROOM	51.0	D04			0	0		
02-61-2-Q	PFD LKR	11.6	D06			0	0		
02-68-1-Q	BATTERY LKR	12.2	D04			0	0		
02-68-2-E	EMERGENCY GEN RM	32.4	D06			0	0		
02-70-0-Q	STACK	18.6	D06			0	0		
(none)	(weather overhead)	44.8	D06			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 01-61-1-L COMPANIONWAY

CUI: LP (Passageway/Staircase/Vestibule)

o GEOMETRY

Compartment Height (ft):	8.0	Vent Area (sq in):	246
Deck Area (sq ft):	38.0	Avg. Vent Ht.(in):	10

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 3 (Full Room Involvement (FRI))
Frequency of Acceptable Loss: 1 per 16 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
2 PKP or Equivalent Dry Chem.
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	99	99	90
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	80	88	72

Frequency of Established Burning (fires/comp/year): 0.0001

o FUEL LOADS

Cellulosics(psf):	2.30	Plastics(psf):	0.20	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	5		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 14 (Stairways)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.0100
Maximum Heat Release Rate, MAXIMUM Q (kW): 14

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	999	999	999
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.0210	0.0210	0.0210

BARRIER FIRE SAFETY SUMMARY

Compartment: 01-61-1-L COMPANIONWAY

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs	and Names)	Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch	Readiness
01-55-0-L	PASSAGE	80.0	B02		B09	-15	-9	DJ	NC
01-55-0-L	PASSAGE	30.4	B02		B09	-15	-9		
01-62-1-L	CO SR	64.0	B09		B02	-15	-9		
01-66-1-L	CO WR,WC SHR	16.0	B09		B03	-15	-9		
01-67-1-A	LINEN LOCKER	30.4	B02		B02	0	0		
1-61-0-L	MESS ROOM	38.0	D04			0	0	HL	Z
02-61-0-C	CHART ROOM	38.0	D04			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 02-58-1-L LADDER

CUI: LP (Passageway/Staircase/Vestibule)

o GEOMETRY

Compartment Height (ft):	8.0	Vent Area (sq in):	0
Deck Area (sq ft):	48.2	Avg. Vent Ht.(in):	0

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 3 (Full Room Involvement (FRI))
Frequency of Acceptable Loss: 1 per 16 ship years

o FIRE DETECTION

FIRE DETECTION	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
1 PKP or Equivalent Dry Chem. 1 CO2
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	99	99	90
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	80	88	72
Frequency of Established Burning (fires/comp/year):			0.0001

o FUEL LOADS

Cellulosics(psf):	1.80	Plastics(psf):	0.20	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	5		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 14 (Stairways)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.0100
Maximum Heat Release Rate, MAXIMUM Q (kW): 15

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	999	999	999
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.0177	0.0177	0.0005

BARRIER FIRE SAFETY SUMMARY

Compartment: 02-58-1-L LADDER

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness	
02-52-0-V	VOID	44.0	B02		B10	-10	-8		
02-52-0-V	VOID	14.0	B02		B10	-10	-8		
02-52-0-V	VOID	25.0	B02		B10	-10	-8		
02-52-0-V	VOID	31.0	B02		B10	-10	-8		
02-52-0-V	VOID	45.0	B02		B10	-10	-8	DJ	NC
02-61-0-C	CHART ROOM	30.4	B02		B02	0	0	DJ	NO
02-52-0-C	PILOTHOUSE	15.0	B02		B02	0	0		
02-52-0-C	PILOTHOUSE	11.4	B02		B02	0	0		
02-52-0-C	PILOTHOUSE	15.0	B02		B02	0	0		
(none)	(weather bulkhead)	11.4	B02	B10		-10	-8		
01-55-0-L	PASSAGE	48.2	D04			0	0		
02-52-0-C	PILOTHOUSE	29.2	D06			0	0		
02-52-0-C	PILOTHOUSE	19.0	D06			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 1-83-0-L ENLISTED WR,WC&SH

CUI: LW (Sanitary Spaces)

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o GEOMETRY

Compartment Height (ft):	8.5	Vent Area (sq in):	25
Deck Area (sq ft):	60.7	Avg. Vent Ht.(in):	5

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 4 (Compartment Burnout (CBO))
Frequency of Acceptable Loss: 1 per 8 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
1 PKP or Equivalent Dry Chem.
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	90	90	72
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	70	77	63
Frequency of Established Burning (fires/comp/year):			0.0002

o FUEL LOADS

Cellulosics(psf):	1.40	Plastics(psf):	0.20	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	10		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 16 (Very low density storage)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.0010
Maximum Heat Release Rate, MAXIMUM Q (kW): 5

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	999	999	999
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.0047	0.0047	0.0047

BARRIER FIRE SAFETY SUMMARY

Compartment: 1-83-0-L ENLISTED WR,WC&SH

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs	and Names)	Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch	Readiness
3-88-0-E	PROPULSION THRUSTER RM	62.9	B10		B09	-10	-8		
1-79-01-L	PASSAGE	62.9	B03		B02	0	0		
1-79-1-L	ENLISTED SR (4)	69.7	B03		B02	0	0	DJ	NO
1-83-2-L	ENLISTED WR,WC&SH	69.7	B03		B03	0	0		
3-79-0-Q	PUMP ROOM	60.7	D04			0	0		
01-76-0-L	ENLISTED SR (4)	37.4	D04			0	0		
(none)	(weather overhead)	23.3	D06			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 1-83-2-L ENLISTED WR,WC&SH

CUI: LW (Sanitary Spaces)

o GEOMETRY

Compartment Height (ft):	8.5	Vent Area (sq in):	25
Deck Area (sq ft):	57.4	Avg. Vent Ht.(in):	5

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 4 (Compartment Burnout (CBO))
Frequency of Acceptable Loss: 1 per 8 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
1 PKP or Equivalent Dry Chem.
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	90	90	72
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	70	77	63

Frequency of Established Burning (fires/comp/year): 0.0002

o FUEL LOADS

Cellulosics(psf):	1.40	Plastics(psf):	0.20	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	10		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 16 (Very low density storage)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.0010
Maximum Heat Release Rate, MAXIMUM Q (kW): 5

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	999	999	999
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.0050	0.0050	0.0049

BARRIER FIRE SAFETY SUMMARY

Compartment: 1-83-2-L ENLISTED WR,WC&SH

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs	and Names)	Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch	Readiness
3-88-0-E	PROPULSION THRUSTER RM	59.5	B10		B09	-10	-8		
1-79-01-L	PASSAGE	59.5	B03		B02	0	0		
1-79-2-L	ENLISTED SR (3+1)	69.7	B03		B02	0	0	DJ	NO
1-83-0-L	ENLISTED WR,WC&SH	69.7	B03		B03	0	0		
3-79-0-Q	PUMP ROOM	57.4	D04			0	0		
01-76-0-L	ENLISTED SR (4)	3.1	D04			0	0		
01-83-2-L	ENLISTED WR,WC&SH	33.3	D04			0	0		
(none)	(weather overhead)	21.0	D06			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 01-58-2-L CPO WR,WC

CUI: LW (Sanitary Spaces)

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o GEOMETRY

Compartment Height (ft):	8.0	Vent Area (sq in):	517
Deck Area (sq ft):	51.1	Avg. Vent Ht.(in):	9

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 4 (Compartment Burnout (CBO))
Frequency of Acceptable Loss: 1 per 8 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
2 PKP or Equivalent Dry Chem.
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	90	90	72
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	70	77	63
Frequency of Established Burning (fires/comp/year):			0.0002

o FUEL LOADS

Cellulosics(psf):	1.40	Plastics(psf):	0.30	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	10		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 16 (Very low density storage)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.0010
Maximum Heat Release Rate, MAXIMUM Q (kW): 5

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	999	999	999
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.0056	0.0056	0.0056

BARRIER FIRE SAFETY SUMMARY

Compartment: 01-58-2-L CPO WR,WC

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs	and Names)	Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness	
01-52-2-L	CPO SR (1)	73.6	B09		B02	-15	-9	DJ	NC
01-55-0-L	PASSAGE	14.4	B03		B09	-15	-9		
01-55-0-L	PASSAGE	12.8	B03		B09	-15	-9		
01-55-0-L	PASSAGE	25.6	B03		B09	-15	-9		
01-61-2-L	CPO SR (1)	86.4	B09		B02	-15	-9	DJ	NC
(none)	(weather bulkhead)	40.0	B03	B10		-10	-8		
1-57-2-Q	ENG OFFICE AND DC CENTRA	51.1	D04			0	0		
02-52-0-V	VOID	51.1	D06			0	0		
(none)	(weather overhead)	21.0	D06			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 01-66-1-L CO WR,WC SHR

CUI: LW (Sanitary Spaces)

o GEOMETRY

Compartment Height (ft):	8.0	Vent Area (sq in):	25
Deck Area (sq ft):	39.5	Avg. Vent Ht.(in):	5

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 4 (Compartment Burnout (CBO))
Frequency of Acceptable Loss: 1 per 8 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
1 PKP or Equivalent Dry Chem.
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	90	90	72
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	70	77	63

Frequency of Established Burning (fires/comp/year): 0.0002

o FUEL LOADS

Cellulosics(psf):	1.80	Plastics(psf):	0.30	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	10		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 16 (Very low density storage)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.0010
Maximum Heat Release Rate, MAXIMUM Q (kW): 5

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	999	999	999
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.0072	0.0072	0.0072

BARRIER FIRE SAFETY SUMMARY

Compartment: 01-66-1-L CO WR,WC SHR

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness	
01-55-0-L	PASSAGE	56.0	B03		B09	-15	-9		
01-61-1-L	COMPANIONWAY	16.0	B03		B09	-15	-9		
01-62-1-L	CO SR	83.2	B09		B02	-15	-9	DJ	NO
01-67-1-A	LINEN LOCKER	14.4	B03		B09	-15	-9		
(none)	(weather bulkhead)	30.4	B03	B10		-10	-8		
(none)	(weather bulkhead)	27.2	B03	B10		-10	-8		
1-61-0-L	MESS ROOM	39.5	D04			0	0		
02-61-0-C	CHART ROOM	11.4	D04			0	0		
02-61-1-Q	PFD LKR	12.2	D06			0	0		
(none)	(weather overhead)	15.9	D06			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 01-74-2-L ENLISTED WR,WC&SH

CUI: LW (Sanitary Spaces)

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o GEOMETRY

Compartment Height (ft):	8.0	Vent Area (sq in):	517
Deck Area (sq ft):	53.3	Avg. Vent Ht.(in):	9

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 4 (Compartment Burnout (CBO))
Frequency of Acceptable Loss: 1 per 8 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
2 PKP or Equivalent Dry Chem.
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	90	90	72
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	70	77	63

Frequency of Established Burning (fires/comp/year): 0.0002

o FUEL LOADS

Cellulosics(psf):	1.50	Plastics(psf):	0.20	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	10		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 16 (Very low density storage)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.0010
Maximum Heat Release Rate, MAXIMUM Q (kW): 5

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	999	999	999
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.0053	0.0053	0.0053

BARRIER FIRE SAFETY SUMMARY

Compartment: 01-74-2-L   ENLISTED WR,WC&SH

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness	
01-55-0-L	PASSAGE	30.4	B03		B09	-15	-9		
01-68-2-L	PO SR (2+2)	86.4	B09		B02	-15	-9	DJ	NC
01-76-2-L	ENLISTED SR (2+2)	48.0	B09		B02	-15	-9	DJ	NC
01-76-2-L	ENLISTED SR (2+2)	19.3	B09		B02	-15	-9		
01-76-2-L	ENLISTED SR (2+2)	25.6	B09		B02	-15	-9		
(none)	(weather bulkhead)	44.8	B03	B10		-10	-8		
1-61-0-L	MESS ROOM	7.2	D04			0	0		
1-61-2-Q	GALLEY	29.9	D04			0	0		
1-76-2-Q	SCULLERY	16.2	D04			0	0		
02-68-2-E	EMERGENCY GEN RM	29.8	D06			0	0		
(none)	(weather overhead)	23.5	D06			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 01-83-2-L ENLISTED WR,WC&SH

CUI: LW (Sanitary Spaces)

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o GEOMETRY

Compartment Height (ft): 8.0 Vent Area (sq in): 271
Deck Area (sq ft): 55.0 Avg. Vent Ht.(in): 8

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 4 (Compartment Burnout (CBO))
Frequency of Acceptable Loss: 1 per 8 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
1 PKP or Equivalent Dry Chem.
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	90	90	72
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	70	77	63

Frequency of Established Burning (fires/comp/year): 0.0002

o FUEL LOADS

Cellulosics(psf): 1.40 Plastics(psf): 0.20 Liquids(gals): 0
Fuel Stack Height(%): NA Deck Area Occupied(%): 10

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 16 (Very low density storage)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.0010
Maximum Heat Release Rate, MAXIMUM Q (kW): 5

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	999	999	999
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.0052	0.0052	0.0052

BARRIER FIRE SAFETY SUMMARY

Compartment: 01-83-2-L ENLISTED WR,WC&SH

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness	
01-76-0-L	ENLISTED SR (4)	17.6	B09		B02	-15	-9		
01-76-0-L	ENLISTED SR (4)	51.2	B09		B02	-15	-9	DJ	NC
01-76-2-L	ENLISTED SR (2+2)	51.2	B09		B02	-15	-9		
01-83-4-Q	TRASH LKR	51.2	B03		B09	-15	-9		
(none)	(weather bulkhead)	68.8	B03	B10		-10	-8		
1-79-01-L	PASSAGE	7.7	D04			0	0		
1-79-2-L	ENLISTED SR (3+1)	14.1	D04			0	0		
1-83-2-L	ENLISTED WR,WC&SH	33.3	D04			0	0		
(none)	(weather overhead)	55.0	D06			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 3-15-0-E HYDRAULIC EQPT RM

CUI: QA (Aux Machinery Spaces)

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o GEOMETRY

Compartment Height (ft):	10.0	Vent Area (sq in):	122
Deck Area (sq ft):	405.0	Avg. Vent Ht.(in):	120

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 2 (Established Burning (EB))
Frequency of Acceptable Loss: 1 per 23 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
2 PKP or Equivalent Dry Chem. 1 CO2
Hose Reels:
3 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	70	70	49
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	40	44	30

Frequency of Established Burning (fires/comp/year): 0.0029

o FUEL LOADS

Cellulosics(psf):	0.50	Plastics(psf):	0.40	Liquids(gals):	35
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	50		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 13 (Greasy, sooty spaces)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.2000
Maximum Heat Release Rate, MAXIMUM Q (kW): 30,580

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	2	2	2
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.1451	0.0167	0.0167

BARRIER FIRE SAFETY SUMMARY

Compartment: 3-15-0-E HYDRAULIC EQPT RM

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs	and Names)	Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch	Readiness
3-6-0-E	BOW THRUSTER ROOM	223.2	B09	B09	B09	-15	-9	DWT	X
2-24-0-AA	CARGO HOLD	292.0	B09	B09	B09	-15	-9	DWT	X
3-6-0-V	VOID	24.8	B09	B09	B09	-15	-9		
(none)	(weather bulkhead)	151.6	B10	H03		0	0		
(none)	(weather bulkhead)	151.6	B10	H03		0	0		
3-15-0-V	VOID	379.5	D04			0	0		
(none)	(weather overhead)	405.0	D06			0	0	S	Y

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 3-42-1-Q POTABLE WATER EQPT RM

CUI: QA (Aux Machinery Spaces)

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o GEOMETRY

Compartment Height (ft):	11.0	Vent Area (sq in):	294
Deck Area (sq ft):	107.0	Avg. Vent Ht.(in):	51

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 3 (Full Room Involvement (FRI))
Frequency of Acceptable Loss: 1 per 13 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
1 PKP or Equivalent Dry Chem. 1 CO2
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	70	70	49
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	40	44	30

Frequency of Established Burning (fires/comp/year): 0.0029

o FUEL LOADS

Cellulosics(psf): 1.30 Plastics(psf): 1.30 Liquids(gals): 0
Fuel Stack Height(%): NA Deck Area Occupied(%): 50

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 13 (Greasy, sooty spaces)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.2000
Maximum Heat Release Rate, MAXIMUM Q (kW): 16,692

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	2	2	2
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.1721	0.1721	0.1721

BARRIER FIRE SAFETY SUMMARY

Compartment: 3-42-1-Q POTABLE WATER EQPT RM

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs	and Names)	Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch	Readiness
3-35-1-W	BALLAST TANK	116.6	B10	B09	B09	-10	-8		
2-35-1-F	FUEL TANK	52.8	B09	B09	B09	-15	-9		
3-42-0-Q	MACHINE SHOP	37.4	B09		B09	-15	-9	DJ	NC
3-42-0-Q	MACHINE SHOP	16.8	B09		B09	-15	-9		
3-42-0-Q	MACHINE SHOP	17.5	B09		B09	-15	-9		
2-44-0-W	FRESH WATER TANK	36.0	B10		B09	-10	-8		
2-44-0-W	FRESH WATER TANK	37.5	B10		B09	-10	-8		
3-47-1-Q	ENGRS STRM	121.0	B09		B09	-15	-9		
(none)	(weather bulkhead)	92.5	B10	H03		0	0		
3-42-0-V	VOID	107.0	D04			0	0		
(none)	(weather overhead)	107.0	D06			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 3-79-0-Q PUMP ROOM

CUI: QA (Aux Machinery Spaces)

o GEOMETRY

Compartment Height (ft):	8.0	Vent Area (sq in):	122
Deck Area (sq ft):	508.1	Avg. Vent Ht.(in):	96

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 3 (Full Room Involvement (FRI))
Frequency of Acceptable Loss: 1 per 19 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
2 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
1 AFFF Sprinkler
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
2 PKP or Equivalent Dry Chem. 1 CO2
Hose Reels:
3 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	70	70	49
By Fixed Suppression Systems (%):	25	28	23
By Manual Suppression Equipment (%):	40	44	30

Frequency of Established Burning (fires/comp/year): 0.0029

o FUEL LOADS

Cellulosics(psf): 0.40 Plastics(psf): 0.30 Liquids(gals): 0
Fuel Stack Height(%): NA Deck Area Occupied(%): 50

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 13 (Greasy, sooty spaces)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.2000
Maximum Heat Release Rate, MAXIMUM Q (kW): 20,324

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	2	2	2
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.7863	0.5944	0.0078

BARRIER FIRE SAFETY SUMMARY

Compartment: 3-79-0-Q PUMP ROOM

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness
3-61-0-E	MAIN ENGINE ROOM	281.6	B09	B09	B10	-10	-8	DWT Z
3-88-0-E	PROPULSION THRUSTER RM	206.4	B09	B09	B09	-15	-9	DWT Z
3-88-0-V	VOID	68.8	B09	B09	B09	-15	-9	
(none)	(weather bulkhead)	116.9	B10	H03		0	0	
(none)	(weather bulkhead)	116.9	B10	H03		0	0	
3-79-0-V	VOID	388.6	D04			0	0	
3-79-1-F	FUEL SERVICE TANK	23.5	D04			0	0	
3-79-2-F	FUEL SERVICE TANK	23.5	D04			0	0	
3-81-1-W	GRAY WTR HOLDING TNK	36.2	D04			0	0	
3-81-2-F	FUEL STRG TNK	36.2	D04			0	0	
1-79-0-L	COMPANIONWAY	35.8	D04			0	0	HL Z
1-79-01-L	PASSAGE	56.3	D04			0	0	
1-79-1-L	ENLISTED SR (4)	140.2	D04			0	0	
1-79-2-L	ENLISTED SR (3+1)	125.6	D04			0	0	
1-83-0-L	ENLISTED WR,WC&SH	60.7	D04			0	0	
1-83-2-L	ENLISTED WR,WC&SH	57.4	D04			0	0	
(none)	(weather overhead)	32.1	D06			0	0	

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 3-88-0-E PROPULSION THRUSTER RM

CUI: QA (Aux Machinery Spaces)

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o GEOMETRY

Compartment Height (ft):	14.5	Vent Area (sq in):	172
Deck Area (sq ft):	682.0	Avg. Vent Ht.(in):	174

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 2 (Established Burning (EB))
Frequency of Acceptable Loss: 1 per 26 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
2 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
1 AFFF Sprinkler
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
1 CO2
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	10	11	6
By Fixed Suppression Systems (%):	25	28	23
By Manual Suppression Equipment (%):	30	60	40

Frequency of Established Burning (fires/comp/year): 0.0029

o FUEL LOADS

Cellulosics(psf):	0.10	Plastics(psf):	1.60	Liquids(gals):	5
Fuel Stack Height(%):	40	Deck Area Occupied(%):	50		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 3 (Storage of stacked plastics in cartons)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.2000
Maximum Heat Release Rate, MAXIMUM Q (kW): 20,181

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	3	3	3
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.4984	0.1693	0.0130

BARRIER FIRE SAFETY SUMMARY

Compartment: 3-88-0-E PROPULSION THRUSTER RM

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness	
3-79-0-Q	PUMP ROOM	206.4	B09	B09	B09	-15	-9	DWT	Z
1-79-1-L	ENLISTED SR (4)	81.6	B09		B10	-10	-8		
1-79-2-L	ENLISTED SR (3+1)	73.1	B09		B10	-10	-8		
1-83-0-L	ENLISTED WR,WC&SH	62.9	B09		B10	-10	-8		
1-83-2-L	ENLISTED WR,WC&SH	59.5	B09		B10	-10	-8		
(none)	(weather bulkhead)	144.2	B10	H03		0	0		
(none)	(weather bulkhead)	144.3	B10	H03		0	0		
(none)	(weather bulkhead)	241.5	B10	H03		0	0		
(none)	(weather bulkhead)	140.6	B10	B10		0	0		
(none)	(weather bulkhead)	140.4	B10	B10		0	0		
(none)	(weather bulkhead)	226.8	B10	B10		0	0		
(none)	(weather bulkhead)	11.2	B10	B10		-10	-8		
(none)	(weather bulkhead)	11.2	B10	B10		-10	-8		
3-88-0-V	VOID	639.4	D04			0	0		
(none)	(weather overhead)	682.0	D06			0	0	HS	Y

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 02-68-2-E EMERGENCY GEN RM

CUI: QE (Emergency Aux Generator Spaces)

o GEOMETRY

Compartment Height (ft):	8.0	Vent Area (sq in):	226
Deck Area (sq ft):	131.4	Avg. Vent Ht.(in):	13

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 2 (Established Burning (EB))
Frequency of Acceptable Loss: 1 per 22 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke 2 Flame

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
1 CO2 Total Flooding
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
2 PKP or Equivalent Dry Chem. 1 CO2
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	60	66	36
By Fixed Suppression Systems (%):	45	50	40
By Manual Suppression Equipment (%):	20	25	18

Frequency of Established Burning (fires/comp/year): 0.0204

o FUEL LOADS

Cellulosics(psf):	0.90	Plastics(psf):	1.70	Liquids(gals):	23
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	50		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 13 (Greasy, sooty spaces)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.2000
Maximum Heat Release Rate, MAXIMUM Q (kW): 28,857

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	2	2	2
Post-FRI Heat Release Rates, POST-FRI Q (kW):	1.7087	1.3236	0.0243

BARRIER FIRE SAFETY SUMMARY

Compartment: 02-68-2-E EMERGENCY GEN RM

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness
02-61-0-C	CHART ROOM	52.8	B10		B02	-10	-8	
02-61-2-Q	PFD LKR	27.2	B10		B09	-10	-8	
02-68-1-Q	BATTERY LKR	27.2	B10		B09	-10	-8	
02-70-0-Q	STACK	92.8	B10		B09	-10	-8	
02-70-0-Q	STACK	12.8	B10		B09	-10	-8	
(none)	(weather bulkhead)	120.0	B09	B10		-10	-8	DWT Z
(none)	(weather bulkhead)	67.2	B09	B10		-10	-8	
01-55-0-L	PASSAGE	32.4	D06			0	0	
01-68-2-L	PO SR (2+2)	59.4	D06			0	0	
01-74-2-L	ENLISTED WR,WC&SH	29.8	D06			0	0	
01-76-2-L	ENLISTED SR (2+2)	9.8	D06			0	0	
(none)	(weather overhead)	131.4	D06			0	0	

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 02-52-0-V VOID

CUI: QF (Fan Room)

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o GEOMETRY

Compartment Height (ft):	5.0	Vent Area (sq in):	192
Deck Area (sq ft):	324.1	Avg. Vent Ht.(in):	4

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 3 (Full Room Involvement (FRI))
Frequency of Acceptable Loss: 1 per 19 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
2 PKP or Equivalent Dry Chem. 1 CO2
Hose Reels:
None
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	90	72	54
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	20	40	15

Frequency of Established Burning (fires/comp/year): 0.0004

o FUEL LOADS

Cellulosics(psf): 0.20 Plastics(psf): 0.20 Liquids(gals): 0
Fuel Stack Height(%): NA Deck Area Occupied(%): 25

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 16 (Very low density storage)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.0010
Maximum Heat Release Rate, MAXIMUM Q (kW): 24

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	999	999	999
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.0042	0.0042	0.0042

BARRIER FIRE SAFETY SUMMARY

Compartment: 02-52-0-V VOID

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs	and Names)	Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch	Readiness
01-50-0-C	BUOY DECK CONTROL ROOM	24.0	B02		B10	-10	-8		
01-50-0-C	BUOY DECK CONTROL ROOM	50.0	B10		B02	-10	-8		
01-50-0-C	BUOY DECK CONTROL ROOM	24.0	B10		B02	-10	-8		
02-58-1-L	LADDER	44.0	B10		B02	-10	-8		
02-58-1-L	LADDER	14.0	B10		B02	-10	-8		
02-58-1-L	LADDER	25.0	B10		B02	-10	-8		
02-58-1-L	LADDER	31.0	B10		B02	-10	-8		
02-58-1-L	LADDER	45.0	B10		B02	-10	-8	DJ	NC
02-61-0-C	CHART ROOM	33.0	B10		B02	-10	-8		
02-61-0-C	CHART ROOM	15.0	B10		B02	-10	-8		
02-61-1-Q	PFD LKR	16.0	B10		B09	-10	-8		
02-61-2-Q	PFD LKR	17.0	B10		B09	-10	-8		
(none)	(weather bulkhead)	74.0	B09	B10		-10	-8		
(none)	(weather bulkhead)	46.0	B09	B10		-10	-8		
(none)	(weather bulkhead)	46.0	B09	B10		-10	-8		
(none)	(weather bulkhead)	74.0	B09	B10		-10	-8		
(none)	(weather bulkhead)	21.0	B09	B10		-10	-8		
(none)	(weather bulkhead)	21.0	B09	B10		-10	-8		
01-52-1-L	CO CABIN	148.2	D06			0	0		
01-52-2-L	CPO SR (1)	90.2	D06			0	0		
01-55-0-L	PASSAGE	34.7	D06			0	0		
01-58-2-L	CPO WR,WC	51.1	D06			0	0		
02-52-0-C	PILOTHOUSE	283.6	D06			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 1-61-2-Q GALLEY

CUI: QG (Galley/Pantry/Scullery)

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o GEOMETRY

Compartment Height (ft):	8.5	Vent Area (sq in):	486
Deck Area (sq ft):	286.1	Avg. Vent Ht.(in):	20

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 2 (Established Burning (EB))
Frequency of Acceptable Loss: 1 per 24 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
1 Aqueous Potassium Carbonate
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
2 PKP or Equivalent Dry Chem.
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	40	40	24
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	30	42	24

Frequency of Established Burning (fires/comp/year): 0.0026

o FUEL LOADS

Cellulosics(psf):	2.10	Plastics(psf):	0.50	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	25		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 13 (Greasy, sooty spaces)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.2000
Maximum Heat Release Rate, MAXIMUM Q (kW): 17,738

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	2	2	2
Post-FRI Heat Release Rates, POST-FRI Q (kW):	1.3829	0.8578	0.0272

BARRIER FIRE SAFETY SUMMARY

Compartment: 1-61-2-Q GALLEY

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness	
1-57-2-Q	ENG OFFICE AND DC CENTRA	105.4	B03		B09	-15	-9		
1-61-0-L	MESS ROOM	86.7	B03		B09	-15	-9	DJ	NC
1-61-0-L	MESS ROOM	8.5	B03		B09	-15	-9		
1-61-0-L	MESS ROOM	119.0	B03		B09	-15	-9	DJ	NO
1-76-2-Q	SCULLERY	96.9	B09		B03	-15	-9	DJ	NO
(none)	(weather bulkhead)	205.7	B03	B10		-10	-8		
3-61-0-E	MAIN ENGINE ROOM	286.1	D06			0	0	S	Y
01-55-0-L	PASSAGE	31.7	D04			0	0		
01-61-2-L	CPO SR (1)	82.3	D04			0	0		
01-68-2-L	PO SR (2+2)	79.2	D04			0	0		
01-74-2-L	ENLISTED WR,WC&SH	29.9	D04			0	0		
(none)	(weather overhead)	63.0	D06			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 1-76-2-Q SCULLERY

CUI: QG (Galley/Pantry/Scullery)

- GEOMETRY

Compartment Height (ft):	8.5	Vent Area (sq in):	96
Deck Area (sq ft):	74.4	Avg. Vent Ht.(in):	4

- FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 2 (Established Burning (EB))
Frequency of Acceptable Loss: 1 per 24 ship years

- FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

- FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
2 PKP or Equivalent Dry Chem.
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

- PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	40	40	24
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	30	42	24

Frequency of Established Burning (fires/comp/year): 0.0026

- FUEL LOADS

Cellulosics(psf): 2.10 Plastics(psf): 0.60 Liquids(gals): 0
Fuel Stack Height(%): NA Deck Area Occupied(%): 25

- FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 13 (Greasy, sooty spaces)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.2000
Maximum Heat Release Rate, MAXIMUM Q (kW): 4,910

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	1	1	1
Post-FRI Heat Release Rates, POST-FRI Q (kW):	3.7532	3.1851	0.0101

BARRIER FIRE SAFETY SUMMARY

Compartment: 1-76-2-Q SCULLERY

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness	
1-61-0-L	MESS ROOM	8.5	B03		B09	-15	-9		
1-61-0-L	MESS ROOM	51.0	B03		B09	-15	-9	DJ	NO
1-61-2-Q	GALLEY	96.9	B03		B09	-15	-9	DJ	NO
1-79-01-L	PASSAGE	27.2	B03		B09	-15	-9		
1-79-2-L	ENLISTED SR (3+1)	73.1	B03		B09	-15	-9		
(none)	(weather bulkhead)	51.0	B03	B10		-10	-8		
(none)	(weather bulkhead)	5.1	B03	B10		-10	-8		
3-61-0-E	MAIN ENGINE ROOM	74.4	D06			0	0		
01-74-2-L	ENLISTED WR,WC&SH	16.2	D04			0	0		
01-76-2-L	ENLISTED SR (2+2)	42.6	D04			0	0		
(none)	(weather overhead)	15.6	D06			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 1-52-3-Q CHANGE RM

CUI: QL (Laundry)

o GEOMETRY

Compartment Height (ft):	8.5	Vent Area (sq in):	540
Deck Area (sq ft):	150.3	Avg. Vent Ht.(in):	9

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 3 (Full Room Involvement (FRI))
Frequency of Acceptable Loss: 1 per 14 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
1 PKP or Equivalent Dry Chem.
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	40	50	30
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	20	30	12

Frequency of Established Burning (fires/comp/year): 0.0031

o FUEL LOADS

Cellulosics(psf):	2.10	Plastics(psf):	0.50	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	25		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 12 (Hanging cellulosics)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.1000
Maximum Heat Release Rate, MAXIMUM Q (kW): 1,969

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	2	2	2
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.0945	0.0945	0.0945

BARRIER FIRE SAFETY SUMMARY

Compartment: 1-52-3-Q CHANGE RM

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs	and Names)	Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness	
1-52-1-L	COMPANIONWAY	85.0	B09		B02	-15	-9	DJ	NC
1-58-1-Q	LAUNDRY	85.0	B02		B03	0	0	DJ	NC
1-58-1-Q	LAUNDRY	40.8	B02		B03	0	0		
1-61-0-L	MESS ROOM	28.9	B09		B02	-15	-9		
(none)	(weather bulkhead)	125.8	B09	B10		-10	-8		
(none)	(weather bulkhead)	113.9	B09	B10		-10	-8		
3-52-1-Q	ELEC/ELEX STRM	99.2	D04			0	0		
3-57-1-Q	ELEC SHOP	51.2	D04			0	0		
01-51-0-V	VOID	7.7	D06			0	0		
01-52-1-L	CO CABIN	102.1	D04			0	0		
(none)	(weather overhead)	38.4	D06			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 1-58-1-Q LAUNDRY

CUI: QL (Laundry)

o GEOMETRY

Compartment Height (ft):	8.5	Vent Area (sq in):	540
Deck Area (sq ft):	48.0	Avg. Vent Ht.(in):	9

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 3 (Full Room Involvement (FRI))
Frequency of Acceptable Loss: 1 per 16 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
1 PKP or Equivalent Dry Chem.
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	40	50	30
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	20	30	12

Frequency of Established Burning (fires/comp/year): 0.0031

o FUEL LOADS

Cellulosics(psf):	3.70	Plastics(psf):	1.80	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	25		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 12 (Hanging cellulosics)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.1000
Maximum Heat Release Rate, MAXIMUM Q (kW): 1,480

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	1	1	1
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.2960	0.2960	0.2960

BARRIER FIRE SAFETY SUMMARY

Compartment: 1-58-1-Q LAUNDRY

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness	
1-52-0-L	PASSAGE	40.8	B03		B09	-15	-9	DJ	NC
1-52-3-Q	CHANGE RM	85.0	B03		B02	0	0	DJ	NC
1-52-3-Q	CHANGE RM	40.8	B03		B02	0	0		
1-61-0-L	MESS ROOM	81.6	B09		B02	-15	-9		
3-57-1-Q	ELEC SHOP	48.0	D04			0	0		
01-52-1-L	CO CABIN	46.1	D04			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 1-52-2-Q SHIP'S OFFICE

CUI: QO (Office Spaces)

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o GEOMETRY

Compartment Height (ft):	8.5	Vent Area (sq in):	342
Deck Area (sq ft):	100.6	Avg. Vent Ht.(in):	7

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 3 (Full Room Involvement (FRI))
Frequency of Acceptable Loss: 1 per 16 ship years

o FIRE DETECTION

FIRE DETECTION	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
1 PKP or Equivalent Dry Chem.
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	30	36	18
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	30	38	18

Frequency of Established Burning (fires/comp/year): 0.0004

o FUEL LOADS

Cellulosics(psf):	7.60	Plastics(psf):	1.40	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	50		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 8 (Office spaces)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.7000
Maximum Heat Release Rate, MAXIMUM Q (kW): 3,923

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	1	1	1
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.3777	0.0558	0.0558

BARRIER FIRE SAFETY SUMMARY

Compartment: 1-52-2-Q SHIP'S OFFICE

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness	
1-52-0-L	PASSAGE	62.9	B02		B09	-15	-9	DJ	NC
1-57-2-Q	ENG OFFICE AND DC CENTRA	115.6	B02		B02	0	0		
(none)	(weather bulkhead)	115.6	B02	B10		-10	-8		
(none)	(weather bulkhead)	62.9	B02	B10		-10	-8		
3-52-0-C	ENGINEERING CONTROL CENT	100.6	D04			0	0	S	Y
01-51-0-V	VOID	8.6	D06			0	0		
01-52-2-L	CPO SR (1)	68.1	D04			0	0		
01-55-0-L	PASSAGE	4.7	D04			0	0		
(none)	(weather overhead)	19.2	D06			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 1-57-2-Q ENG OFFICE AND DC CENTRAL

CUI: QO (Office Spaces)

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o GEOMETRY

Compartment Height (ft):	8.5	Vent Area (sq in):	342
Deck Area (sq ft):	100.6	Avg. Vent Ht.(in):	7

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 3 (Full Room Involvement (FRI))
Frequency of Acceptable Loss: 1 per 16 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
1 PKP or Equivalent Dry Chem.
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	30	36	18
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	30	38	18

Frequency of Established Burning (fires/comp/year): 0.0004

o FUEL LOADS

Cellulosics(psf): 7.30 Plastics(psf): 1.30 Liquids(gals): 0
Fuel Stack Height(%): NA Deck Area Occupied(%): 50

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 8 (Office spaces)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.7000
Maximum Heat Release Rate, MAXIMUM Q (kW): 3,735

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	1	1	1
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.0789	0.0789	0.0789

BARRIER FIRE SAFETY SUMMARY

Compartment: 1-57-2-Q ENG OFFICE AND DC CENTRAL

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness	
1-52-0-L	PASSAGE	62.9	B02		B09	-15	-9	DJ	NC
1-52-2-Q	SHIP'S OFFICE	115.6	B02		B02	0	0		
1-61-0-L	MESS ROOM	10.2	B09		B09	-15	-9		
1-61-2-Q	GALLEY	105.4	B09		B03	-15	-9		
(none)	(weather bulkhead)	62.9	B02	B10		-10	-8		
3-52-0-C	ENGINEERING CONTROL CENT	100.6	D04			0	0		
01-52-2-L	CPO SR (1)	22.1	D04			0	0		
01-55-0-L	PASSAGE	8.2	D04			0	0		
01-58-2-L	CPO WR,WC	51.1	D04			0	0		
(none)	(weather overhead)	19.2	D06			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 02-61-0-C CHART ROOM

CUI: QO (Office Spaces)

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o GEOMETRY

Compartment Height (ft):	8.0	Vent Area (sq in):	96
Deck Area (sq ft):	158.1	Avg. Vent Ht.(in):	4

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 2 (Established Burning (EB))
Frequency of Acceptable Loss: 1 per 26 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
1 PKP or Equivalent Dry Chem. 1 CO2
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	30	36	18
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	30	38	18

Frequency of Established Burning (fires/comp/year): 0.0004

o FUEL LOADS

Cellulosics(psf): 4.40 Plastics(psf): 2.00 Liquids(gals): 0
Fuel Stack Height(%): NA Deck Area Occupied(%): 25

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 8 (Office spaces)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.7000
Maximum Heat Release Rate, MAXIMUM Q (kW): 2,490

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	1	1	1
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.8957	0.8957	0.4996

BARRIER FIRE SAFETY SUMMARY

Compartment: 02-61-0-C CHART ROOM

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness	
02-52-0-V	VOID	33.0	B02		B10	-10	-8		
02-52-0-V	VOID	15.0	B02		B10	-10	-8		
02-58-1-L	LADDER	30.4	B02		B02	0	0	DJ	NO
02-61-1-Q	PFD LKR	94.4	B04		B09	-15	-9		
02-61-2-Q	PFD LKR	94.4	B04		B09	-15	-9		
02-68-1-Q	BATTERY LKR	28.8	B04		B09	-15	-9		
02-68-2-E	EMERGENCY GEN RM	52.8	B02		B10	-10	-8		
02-52-0-C	PILOTHOUSE	9.0	B02		B02	0	0	DO	O
02-52-0-C	PILOTHOUSE	19.8	B02		B02	0	0		
(none)	(weather bulkhead)	25.6	B02	B10		-10	-8		
01-55-0-L	PASSAGE	51.0	D04			0	0		
01-61-1-L	COMPANIONWAY	38.0	D04			0	0		
01-61-2-L	CPO SR (1)	26.9	D04			0	0		
01-62-1-L	CO SR	24.0	D04			0	0		
01-66-1-L	CO WR,WC SHR	11.4	D04			0	0		
01-67-1-A	LINEN LOCKER	6.8	D04			0	0		
(none)	(weather overhead)	158.1	D06			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 3-42-0-Q MACHINE SHOP

CUI: QS (Shops)

o GEOMETRY

Compartment Height (ft):	11.0	Vent Area (sq in):	307
Deck Area (sq ft):	280.8	Avg. Vent Ht.(in):	71

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 3 (Full Room Involvement (FRI))
Frequency of Acceptable Loss: 1 per 9 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
1 PKP or Equivalent Dry Chem. 1 CO2
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	30	20	10
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	20	40	10
Frequency of Established Burning (fires/comp/year):			0.0018

o FUEL LOADS

Cellulosics(psf):	0.30	Plastics(psf):	0.20	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	50		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 7 (Polyethylene wire insulation; polysynthetics)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.0100
Maximum Heat Release Rate, MAXIMUM Q (kW): 1,278

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	8	8	8
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.2588	0.2588	0.0305

BARRIER FIRE SAFETY SUMMARY

Compartment: 3-42-0-Q MACHINE SHOP

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness	
3-35-2-W	BALLAST TANK	114.4	B10	B09	B09	-10	-8		
2-35-2-F	FUEL TANK	55.0	B09	B09	B09	-15	-9		
3-35-0-Q	PASSAGE	39.6	B09	B09	B09	-15	-9	DWT	Z
3-42-1-Q	POTABLE WATER EQPT RM	37.4	B09		B09	-15	-9	DJ	NC
3-42-1-Q	POTABLE WATER EQPT RM	16.8	B09		B09	-15	-9		
3-42-1-Q	POTABLE WATER EQPT RM	17.5	B09		B09	-15	-9		
2-44-0-W	FRESH WATER TANK	81.0	B10		B09	-10	-8		
2-44-0-W	FRESH WATER TANK	49.5	B10		B09	-10	-8		
2-44-0-W	FRESH WATER TANK	64.5	B10		B09	-10	-8		
3-47-1-Q	ENGRS STRM	74.8	B01		B01	-15	-9	DJ	NC
3-47-1-Q	ENGRS STRM	9.1	B09		B01	-15	-9		
3-47-1-Q	ENGRS STRM	5.6	B09		B01	-15	-9		
3-52-0-C	ENGINEERING CONTROL CENT	231.0	B04	B09	B04	-15	-9	DWT	Z
3-52-1-Q	ELEC/ELEX STRM	6.6	B09	B09	B09	-15	-9		
(none)	(weather bulkhead)	184.8	B10	H03		0	0		
3-42-0-V	VOID	280.8	D04			0	0		
2-44-0-W	FRESH WATER TANK	88.4	D04			0	0		
(none)	(weather overhead)	280.8	D06			0	0	HS	Y

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 3-57-1-Q ELEC SHOP

CUI: QS (Shops)

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o GEOMETRY

Compartment Height (ft):	11.0	Vent Area (sq in):	307
Deck Area (sq ft):	105.1	Avg. Vent Ht.(in):	71

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 3 (Full Room Involvement (FRI))
Frequency of Acceptable Loss: 1 per 9 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
1 PKP or Equivalent Dry Chem. 1 CO2
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	30	20	10
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	20	40	10

Frequency of Established Burning (fires/comp/year): 0.0018

o FUEL LOADS

Cellulosics(psf): 0.50 Plastics(psf): 0.50 Liquids(gals): 0
Fuel Stack Height(%): NA Deck Area Occupied(%): 50

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 7 (Polyethylene wire insulation; polysynthetics)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.0100
Maximum Heat Release Rate, MAXIMUM Q (kW): 1,025

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	5	5	5
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.2159	0.2159	0.2159

BARRIER FIRE SAFETY SUMMARY

Compartment: 3-57-1-Q ELEC SHOP

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness	
3-61-0-E	MAIN ENGINE ROOM	156.2	B09	B09	B10	-10	-8		
3-52-0-C	ENGINEERING CONTROL CENT	81.4	B09		B04	-15	-9	DJ	NC
3-52-1-Q	ELEC/ELEX STRM	156.2	B01		B01	0	0	DJ	NC
(none)	(weather bulkhead)	81.4	B10	H03		0	0		
3-52-0-V	VOID	105.1	D04			0	0		
1-52-3-Q	CHANGE RM	51.2	D04			0	0		
1-58-1-Q	LAUNDRY	48.0	D04			0	0		
(none)	(weather overhead)	5.9	D06			0	0		

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 1-6-1-Q SERVICE LKR

CUI: QS (Shops)

o GEOMETRY

Compartment Height (ft):	8.5	Vent Area (sq in):	307
Deck Area (sq ft):	102.0	Avg. Vent Ht.(in):	56

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 3 (Full Room Involvement (FRI))
Frequency of Acceptable Loss: 1 per 9 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
2 PKP or Equivalent Dry Chem. 1 CO2
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	30	20	10
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	20	40	10

Frequency of Established Burning (fires/comp/year): 0.0018

o FUEL LOADS

Cellulosics(psf): 0.40 Plastics(psf): 0.30 Liquids(gals): 0
Fuel Stack Height(%): NA Deck Area Occupied(%): 25

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 13 (Greasy, sooty spaces)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.2000
Maximum Heat Release Rate, MAXIMUM Q (kW): 2,040

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	2	2	2
Post-FRI Heat Release Rates, POST-FRI Q (kW):	1.1374	1.1374	0.0747

BARRIER FIRE SAFETY SUMMARY

Compartment: 1-6-1-Q SERVICE LKR

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness
2-4-1-A	CHAIN LKR	28.9	B09		B09	-15	-9	
1-0-0-Q	BOATSWAIN STRM	28.9	B09		B09	-15	-9	DWT Z
1-6-2-Q	ATON SHOP	127.5	B09		B10	-10	-8	
1-6-3-Q	PAINT LKR	127.5	B09		B09	-15	-9	DJ NC
(none)	(weather bulkhead)	57.8	B09	B10		-10	-8	DWT Z
3-6-0-E	BOW THRUSTER ROOM	101.6	D04			0	0	
(none)	(weather overhead)	102.0	D06			0	0	

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 1-6-2-Q ATON SHOP

CUI: QS (Shops)

- GEOMETRY

Compartment Height (ft):	8.5	Vent Area (sq in):	86
Deck Area (sq ft):	199.5	Avg. Vent Ht.(in):	102

- FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 3 (Full Room Involvement (FRI))
Frequency of Acceptable Loss: 1 per 18 ship years

- FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

- FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
2 PKP or Equivalent Dry Chem. 1 CO2
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

- PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	30	20	10
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	20	40	10

Frequency of Established Burning (fires/comp/year): 0.0018

- FUEL LOADS

Cellulosics(psf):	0.40	Plastics(psf):	0.20	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	25		

- FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 13 (Greasy, sooty spaces)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.2000
Maximum Heat Release Rate, MAXIMUM Q (kW): 3,192

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	2	2	2
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.9100	0.9100	0.0156

BARRIER FIRE SAFETY SUMMARY

Compartment: 1-6-2-Q ATON SHOP

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs	and Names)	Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness
2-4-2-A	CHAIN LKR	28.9	B10		B09	-10	-8	
1-0-0-Q	BOATSWAIN STRM	64.6	B10		B09	-10	-8	
1-6-1-Q	SERVICE LKR	127.5	B10		B09	-10	-8	
(none)	(weather bulkhead)	133.4	B09	B10		-10	-8	
(none)	(weather bulkhead)	132.6	B09	B10		-10	-8	DWT Z
3-6-0-E	BOW THRUSTER ROOM	139.5	D06			0	0	HWS Y
(none)	(weather overhead)	199.5	D06			0	0	

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 1-70-1-Q UPTAKE

CUI: TU (Stacks/Engine Uptakes)

o GEOMETRY

Compartment Height (ft):	16.5	Vent Area (sq in):	0
Deck Area (sq ft):	66.0	Avg. Vent Ht.(in):	0

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 2 (Established Burning (EB))
Frequency of Acceptable Loss: 1 per 21 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
2 CO2 2 PKP or Equivalent Dry Chem.
Hose Reels:
2 AFFF
Fire Main Stations:
2 Seawater Only

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	20	22	12
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	20	26	12

Frequency of Established Burning (fires/comp/year): 0.0013

o FUEL LOADS

Cellulosics(psf): 0.60 Plastics(psf): 1.10 Liquids(gals): 0
Fuel Stack Height(%): NA Deck Area Occupied(%): 25

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 13 (Greasy, sooty spaces)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.2000
Maximum Heat Release Rate, MAXIMUM Q (kW): 3,696

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	2	2	2
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.0005	0.0005	0.0005

BARRIER FIRE SAFETY SUMMARY

Compartment: 1-70-1-Q UPTAKE

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness
1-61-0-L	MESS ROOM	85.0	B10		B02	-10	-8	
1-61-0-L	MESS ROOM	56.1	B10		B02	-10	-8	
1-61-0-L	MESS ROOM	85.0	B10		B02	-10	-8	
1-61-0-L	MESS ROOM	56.1	B10		B02	-10	-8	
01-55-0-L	PASSAGE	80.0	B10		B09	-10	-8	
01-55-0-L	PASSAGE	52.8	B10		B09	-10	-8	
01-70-1-Q	BOAT LKR	40.0	B09		B10	-10	-8	
01-76-0-L	ENLISTED SR (4)	52.8	B10		B02	-10	-8	
(none)	(weather bulkhead)	40.0	B10	B10		-10	-8	
3-61-0-E	MAIN ENGINE ROOM	66.0	D00			0	0	
02-70-0-Q	STACK	36.0	D00			0	0	
(none)	(weather overhead)	30.0	D06			0	0	

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 02-70-0-Q STACK

CUI: TU (Stacks/Engine Uptakes)

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o GEOMETRY

Compartment Height (ft):	8.0	Vent Area (sq in):	1296
Deck Area (sq ft):	60.3	Avg. Vent Ht.(in):	48

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 2 (Established Burning (EB))
Frequency of Acceptable Loss: 1 per 21 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
1 Smoke

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
None
Hose Reels:
None
Fire Main Stations:
None

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	20	22	12
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	20	26	12

Frequency of Established Burning (fires/comp/year): 0.0013

o FUEL LOADS

Cellulosics(psf):	0.20	Plastics(psf):	0.80	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	25		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 13 (Greasy, sooty spaces)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.2000
Maximum Heat Release Rate, MAXIMUM Q (kW): 2,171

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	2	2	2
Post-FRI Heat Release Rates, POST-FRI Q (kW):	1.3060	1.3060	1.3060

BARRIER FIRE SAFETY SUMMARY

Compartment: 02-70-0-Q STACK

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs	and Names)	Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness
02-68-1-Q	BATTERY LKR	28.8	B09		B09	-15	-9	
02-68-2-E	EMERGENCY GEN RM	92.8	B09		B10	-10	-8	
02-68-2-E	EMERGENCY GEN RM	12.8	B09		B10	-10	-8	
(none)	(weather bulkhead)	92.8	B09	B10		-10	-8	
(none)	(weather bulkhead)	41.6	B09	B10		-10	-8	
1-70-1-Q	UPTAKE	36.0	D00			0	0	
01-55-0-L	PASSAGE	18.6	D06			0	0	
01-76-0-L	ENLISTED SR (4)	5.8	D06			0	0	
(none)	(weather overhead)	60.3	D06			0	0	

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 3-4-0-V VOID

CUI: V (Voids/Cofferdams)

o GEOMETRY

Compartment Height (ft):	2.5	Vent Area (sq in):	0
Deck Area (sq ft):	30.7	Avg. Vent Ht.(in):	0

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 4 (Compartment Burnout (CBO))
Frequency of Acceptable Loss: 1 per 8 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	0	0
Estimated Time to Detection (min):	16	16

AUTOMATIC DETECTION SYSTEMS:
None

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
None
Hose Reels:
None
Fire Main Stations:
None

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	99	99	99
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	99	99	99
Frequency of Established Burning (fires/comp/year):			0.0001

o FUEL LOADS

Cellulosics(psf): 0.00 Plastics(psf): 0.00 Liquids(gals): 0
Fuel Stack Height(%): NA Deck Area Occupied(%): 0

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 16 (Very low density storage)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.0010
Maximum Heat Release Rate, MAXIMUM Q (kW): 0

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	999	999	999
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.0005	0.0005	0.0005

BARRIER FIRE SAFETY SUMMARY

Compartment: 3-4-0-V VOID

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness
3-6-0-V	VOID	18.6	B09	B09	B09	-15	-9	
3-6-0-E	BOW THRUSTER ROOM	12.4	B09	B09	B09	-15	-9	
(none)	(weather bulkhead)	10.6	B09	H03		0	0	
(none)	(weather bulkhead)	17.0	B09	H03		0	0	
(none)	(weather bulkhead)	10.6	B09	H03		0	0	
3-0-0-V	FOREPEAK	9.0	D04			0	0	
2-4-1-A	CHAIN LKR	10.9	D02			0	0	
2-4-2-A	CHAIN LKR	10.9	D02			0	0	

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 3-6-0-V VOID

CUI: V (Voids/Cofferdams)

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o GEOMETRY

Compartment Height (ft): 5.5 Vent Area (sq in): 0
Deck Area (sq ft): 279.0 Avg. Vent Ht.(in): 0

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 4 (Compartment Burnout (CBO))
Frequency of Acceptable Loss: 1 per 8 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	0	0
Estimated Time to Detection (min):	16	16

AUTOMATIC DETECTION SYSTEMS:
None

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
None
Hose Reels:
None
Fire Main Stations:
None

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	99	99	99
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	99	99	99

Frequency of Established Burning (fires/comp/year): 0.0001

o FUEL LOADS

Cellulosics(psf): 0.00 Plastics(psf): 0.00 Liquids(gals): 0
Fuel Stack Height(%): NA Deck Area Occupied(%): 0

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 16 (Very low density storage)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.0010
Maximum Heat Release Rate, MAXIMUM Q (kW): 0

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	999	999	999
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.0005	0.0005	0.0005

BARRIER FIRE SAFETY SUMMARY

Compartment: 3-6-0-V VOID

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness
3-4-0-V	VOID	18.6	B09	B09	B09	-15	-9	
3-15-0-V	VOID	96.3	B09	B09	B09	-15	-9	
3-15-0-E	HYDRAULIC EQPT RM	24.8	B09	B09	B09	-15	-9	
(none)	(weather bulkhead)	89.3	B09	H03		0	0	
(none)	(weather bulkhead)	89.3	B09	H03		0	0	
(none)	(weather bulkhead)	8.8	B09	H03		0	0	
(none)	(weather bulkhead)	9.9	B09	H03		0	0	
3-6-0-E	BOW THRUSTER ROOM	279.0	D04			0	0	

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 3-15-0-V VOID

CUI: V (Voids/Cofferdams)

- GEOMETRY

Compartment Height (ft):	4.5	Vent Area (sq in):	0
Deck Area (sq ft):	379.5	Avg. Vent Ht.(in):	0

- FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 4 (Compartment Burnout (CBO))
Frequency of Acceptable Loss: 1 per 8 ship years

- FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	0	0
Estimated Time to Detection (min):	16	16

AUTOMATIC DETECTION SYSTEMS:
None

- FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
None
Hose Reels:
None
Fire Main Stations:
None

- PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	99	99	99
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	99	99	99
Frequency of Established Burning (fires/comp/year):			0.0001

- FUEL LOADS

Cellulosics(psf):	0.00	Plastics(psf):	0.00	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	0		

- FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 16 (Very low density storage)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.0010
Maximum Heat Release Rate, MAXIMUM Q (kW): 0

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	999	999	999
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.0005	0.0005	0.0005

BARRIER FIRE SAFETY SUMMARY

Compartment: 3-15-0-V VOID

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness
3-6-0-V	VOID	96.3	B09	B09	B09	-15	-9	
3-24-0-V	VOID	102.2	B09	B09	B09	-15	-9	
2-24-0-AA	CARGO HOLD	29.2	B09	B09	B09	-15	-9	
(none)	(weather bulkhead)	69.6	B09	H03		0	0	
(none)	(weather bulkhead)	69.8	B09	H03		0	0	
3-15-0-E	HYDRAULIC EQPT RM	379.5	D04			0	0	

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 3-24-0-V VOID

CUI: V (Voids/Cofferdams)

o GEOMETRY

Compartment Height (ft):	3.5	Vent Area (sq in):	0
Deck Area (sq ft):	577.8	Avg. Vent Ht.(in):	0

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 4 (Compartment Burnout (CBO))
Frequency of Acceptable Loss: 1 per 8 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	0	0
Estimated Time to Detection (min):	16	16

AUTOMATIC DETECTION SYSTEMS:
None

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
None
Hose Reels:
None
Fire Main Stations:
None

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	99	99	99
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	99	99	99

Frequency of Established Burning (fires/comp/year): 0.0001

o FUEL LOADS

Cellulosics(psf):	0.00	Plastics(psf):	0.00	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	0		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 16 (Very low density storage)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.0010
Maximum Heat Release Rate, MAXIMUM Q (kW): 0

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	999	999	999
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.0005	0.0005	0.0005

BARRIER FIRE SAFETY SUMMARY

Compartment: 3-24-0-V VOID

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness
3-15-0-V	VOID	102.2	B09	B09	B09	-15	-9	
3-35-0-V	VOID	46.9	B09	B09	B09	-15	-9	
3-35-1-W	BALLAST TANK	35.7	B09	B09	B09	-15	-9	
3-35-2-W	BALLAST TANK	35.0	B09	B09	B09	-15	-9	
(none)	(weather bulkhead)	64.9	B09	H03		0	0	
(none)	(weather bulkhead)	64.9	B09	H03		0	0	
2-24-0-AA	CARGO HOLD	577.8	D04			0	0	

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 3-35-0-V VOID

CUI: V (Voids/Cofferdams)

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o GEOMETRY

Compartment Height (ft):	3.5	Vent Area (sq in):	0
Deck Area (sq ft):	137.4	Avg. Vent Ht.(in):	0

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 4 (Compartment Burnout (CBO))
Frequency of Acceptable Loss: 1 per 8 ship years

o FIRE DETECTION

FIRE DETECTION	IN PORT	AT SEA
Percent of Time Monitored:	0	0
Estimated Time to Detection (min):	16	16

AUTOMATIC DETECTION SYSTEMS:
None

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
None
Hose Reels:
None
Fire Main Stations:
None

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	99	99	99
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	99	99	99

Frequency of Established Burning (fires/comp/year): 0.0001

o FUEL LOADS

Cellulosics(psf):	0.00	Plastics(psf):	0.00	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	0		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 16 (Very low density storage)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.0010
Maximum Heat Release Rate, MAXIMUM Q (kW): 0

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	999	999	999
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.0005	0.0005	0.0005

BARRIER FIRE SAFETY SUMMARY

Compartment: 3-35-0-V VOID

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness
3-24-0-V	VOID	46.9	B09	B09	B09	-15	-9	
3-35-1-W	BALLAST TANK	40.6	B09		B09	-15	-9	
3-35-2-W	BALLAST TANK	40.6	B09		B09	-15	-9	
3-39-0-F	FUEL OVERFLOW TNK	17.5	B09		B09	-15	-9	
3-39-0-F	FUEL OVERFLOW TNK	12.6	B09		B09	-15	-9	
3-39-0-F	FUEL OVERFLOW TNK	17.5	B09		B09	-15	-9	
3-42-0-V	VOID	16.8	B09	B09	B09	-15	-9	
3-42-0-V	VOID	17.5	B09	B09	B09	-15	-9	
2-35-1-F	FUEL TANK	55.7	D04			0	0	
2-35-2-F	FUEL TANK	58.0	D04			0	0	
3-35-0-Q	PASSAGE	23.8	D04			0	0	

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 3-42-0-V VOID

CUI: V (Voids/Cofferdams)

- GEOMETRY

Compartment Height (ft):	3.5	Vent Area (sq in):	0
Deck Area (sq ft):	591.4	Avg. Vent Ht.(in):	0

- FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 4 (Compartment Burnout (CBO))
Frequency of Acceptable Loss: 1 per 8 ship years

- FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	0	0
Estimated Time to Detection (min):	16	16

AUTOMATIC DETECTION SYSTEMS:
None

- FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
None
Hose Reels:
None
Fire Main Stations:
None

- PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	99	99	99
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	99	99	99

Frequency of Established Burning (fires/comp/year): 0.0001

- FUEL LOADS

Cellulosics(psf):	0.00	Plastics(psf):	0.00	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	0		

- FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 16 (Very low density storage)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.0010
Maximum Heat Release Rate, MAXIMUM Q (kW): 0

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	999	999	999
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.0005	0.0005	0.0005

BARRIER FIRE SAFETY SUMMARY

Compartment: 3-42-0-V VOID

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness
3-35-0-V	VOID	16.8	B09	B09	B09	-15	-9	
3-35-0-V	VOID	17.5	B09	B09	B09	-15	-9	
3-35-1-W	BALLAST TANK	38.5	B09	B09	B09	-15	-9	
3-35-2-W	BALLAST TANK	37.8	B09	B09	B09	-15	-9	
3-39-0-F	FUEL OVERFLOW TNK	12.6	B09	B09	B09	-15	-9	
3-52-0-V	VOID	123.2	B09	B09	B09	-15	-9	
(none)	(weather bulkhead)	58.8	B09	H03		0	0	
(none)	(weather bulkhead)	58.8	B09	H03		0	0	
3-42-0-Q	MACHINE SHOP	280.8	D04			0	0	
3-42-1-Q	POTABLE WATER EQPT RM	107.0	D04			0	0	
2-44-0-W	FRESH WATER TANK	88.4	D04			0	0	
3-47-1-Q	ENGRS STRM	110.1	D04			0	0	

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 3-52-0-V VOID

CUI: V (Voids/Cofferdams)

---

o GEOMETRY

Compartment Height (ft):	3.5	Vent Area (sq in):	0
Deck Area (sq ft):	521.0	Avg. Vent Ht.(in):	0

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 4 (Compartment Burnout (CBO))
Frequency of Acceptable Loss: 1 per 8 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	0	0
Estimated Time to Detection (min):	16	16

AUTOMATIC DETECTION SYSTEMS:
None

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
None
Hose Reels:
None
Fire Main Stations:
None

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	99	99	99
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	99	99	99

Frequency of Established Burning (fires/comp/year): 0.0001

o FUEL LOADS

Cellulosics(psf):	0.00	Plastics(psf):	0.00	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	0		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 16 (Very low density storage)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.0010
Maximum Heat Release Rate, MAXIMUM Q (kW): 0

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	999	999	999
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.0005	0.0005	0.0005

BARRIER FIRE SAFETY SUMMARY

Compartment: 3-52-0-V VOID

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness
3-42-0-V	VOID	123.2	B09	B09	B09	-15	-9	
3-61-0-E	MAIN ENGINE ROOM	123.2	B09	B09	B09	-15	-9	
(none)	(weather bulkhead)	51.8	B09	H03		0	0	
(none)	(weather bulkhead)	51.8	B09	H03		0	0	
3-52-0-C	ENGINEERING CONTROL CENT	310.8	D06			0	0	
3-52-1-Q	ELEC/ELEX STRM	105.1	D06			0	0	
3-57-1-Q	ELEC SHOP	105.1	D04			0	0	

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 3-79-0-V VOID

CUI: V (Voids/Cofferdams)

o GEOMETRY

Compartment Height (ft):	4.5	Vent Area (sq in):	0
Deck Area (sq ft):	388.7	Avg. Vent Ht.(in):	0

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 4 (Compartment Burnout (CBO))
Frequency of Acceptable Loss: 1 per 8 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	0	0
Estimated Time to Detection (min):	16	16

AUTOMATIC DETECTION SYSTEMS:
None

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
None
Hose Reels:
None
Fire Main Stations:
None

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	99	99	99
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	99	99	99
Frequency of Established Burning (fires/comp/year):			0.0001

o FUEL LOADS

Cellulosics(psf):	0.00	Plastics(psf):	0.00	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	0		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 16 (Very low density storage)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.0010
Maximum Heat Release Rate, MAXIMUM Q (kW): 0

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	999	999	999
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.0005	0.0005	0.0005

BARRIER FIRE SAFETY SUMMARY

Compartment: 3-79-0-V VOID

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness
3-61-0-E	MAIN ENGINE ROOM	25.2	B09	B09	B09	-15	-9	
3-61-0-E	MAIN ENGINE ROOM	25.2	B09	B09	B09	-15	-9	
3-77-0-F	WASTE OIL TANK	23.0	B09	B09	B09	-15	-9	
3-79-1-F	FUEL SERVICE TANK	14.4	B09		B09	-15	-9	
3-79-2-F	FUEL SERVICE TANK	14.4	B09		B09	-15	-9	
3-81-1-W	GRAY WTR HOLDING TNK	32.4	B09		B09	-15	-9	
3-81-1-W	GRAY WTR HOLDING TNK	22.5	B09		B09	-15	-9	
3-81-2-F	FUEL STRG TNK	32.4	B09		B09	-15	-9	
3-81-2-F	FUEL STRG TNK	22.5	B09		B09	-15	-9	
3-88-0-V	VOID	86.0	B09	B09	B09	-15	-9	
(none)	(weather bulkhead)	28.8	B09	H03		0	0	
(none)	(weather bulkhead)	28.8	B09	H03		0	0	
3-79-0-Q	PUMP ROOM	388.6	D04			0	0	

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 3-88-0-V VOID

CUI: V (Voids/Cofferdams)

o GEOMETRY

Compartment Height (ft):	4.5	Vent Area (sq in):	0
Deck Area (sq ft):	639.4	Avg. Vent Ht.(in):	0

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 4 (Compartment Burnout (CBO))
Frequency of Acceptable Loss: 1 per 8 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	0	0
Estimated Time to Detection (min):	16	16

AUTOMATIC DETECTION SYSTEMS:
None

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
None
Hose Reels:
None
Fire Main Stations:
None

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	99	99	99
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	99	99	99

Frequency of Established Burning (fires/comp/year): 0.0001

o FUEL LOADS

Cellulosics(psf): 0.00 Plastics(psf): 0.00 Liquids(gals): 0
Fuel Stack Height(%): NA Deck Area Occupied(%): 0

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 16 (Very low density storage)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.0010
Maximum Heat Release Rate, MAXIMUM Q (kW): 0

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	999	999	999
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.0005	0.0005	0.0005

BARRIER FIRE SAFETY SUMMARY

Compartment: 3-88-0-V VOID

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness
3-79-0-V	VOID	86.0	B09	B09	B09	-15	-9	
3-79-0-Q	PUMP ROOM	68.8	B09	B09	B09	-15	-9	
(none)	(weather bulkhead)	86.5	B09	H03		0	0	
(none)	(weather bulkhead)	86.6	B09	H03		0	0	
(none)	(weather bulkhead)	144.9	B09	H03		0	0	
3-88-0-E	PROPULSION THRUSTER RM	639.4	D04			0	0	

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 01-51-0-V VOID

CUI: V (Voids/Cofferdams)

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o GEOMETRY

Compartment Height (ft):	4.0	Vent Area (sq in):	0
Deck Area (sq ft):	90.0	Avg. Vent Ht.(in):	0

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 3 (Full Room Involvement (FRI))
Frequency of Acceptable Loss: 1 per 17 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	95	95
Estimated Time to Detection (min):	1	1

AUTOMATIC DETECTION SYSTEMS:
None

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
None
Hose Reels:
None
Fire Main Stations:
None

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	90	90	90
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	90	90	90

Frequency of Established Burning (fires/comp/year): 0.0001

o FUEL LOADS

Cellulosics(psf):	0.10	Plastics(psf):	0.30	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	10		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 16 (Very low density storage)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.0010
Maximum Heat Release Rate, MAXIMUM Q (kW): 3

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	999	999	999
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.0005	0.0005	0.0005

BARRIER FIRE SAFETY SUMMARY

Compartment: 01-51-0-V VOID

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness
01-52-1-L	CO CABIN	4.8	B10		B02	-10	-8	
01-52-1-L	CO CABIN	19.2	B10		B02	-10	-8	
01-52-2-L	CPO SR (1)	19.2	B10		B02	-10	-8	
01-55-0-L	PASSAGE	35.2	B10		B09	-10	-8	
(none)	(weather bulkhead)	40.0	B09	B10		-10	-8	
(none)	(weather bulkhead)	16.8	B09	B10		-10	-8	
(none)	(weather bulkhead)	16.8	B09	B10		-10	-8	
1-52-0-L	PASSAGE	15.4	D06			0	0	
1-52-1-L	COMPANIONWAY	16.3	D06			0	0	
1-52-2-Q	SHIP'S OFFICE	8.6	D06			0	0	
1-52-3-Q	CHANGE RM	7.7	D06			0	0	
01-50-0-C	BUOY DECK CONTROL ROOM	90.0	D06			0	0	

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 3-35-1-W BALLAST TANK

CUI: W (Water Tank (empty))

o GEOMETRY

Compartment Height (ft):	14.5	Vent Area (sq in):	0
Deck Area (sq ft):	126.4	Avg. Vent Ht.(in):	0

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 4 (Compartment Burnout (CBO))
Frequency of Acceptable Loss: 1 per 8 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	0	0
Estimated Time to Detection (min):	16	16

AUTOMATIC DETECTION SYSTEMS:
None

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
None
Hose Reels:
None
Fire Main Stations:
None

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	99	99	99
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	99	99	99

Frequency of Established Burning (fires/comp/year): 0.0004

o FUEL LOADS

Cellulosics(psf):	0.00	Plastics(psf):	0.00	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	0		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 16 (Very low density storage)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.0010
Maximum Heat Release Rate, MAXIMUM Q (kW): 0

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	999	999	999
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.0005	0.0005	0.0005

BARRIER FIRE SAFETY SUMMARY

Compartment: 3-35-1-W BALLAST TANK

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness
3-24-0-V	VOID	35.7	B09	B09	B09	-15	-9	
3-35-0-V	VOID	40.6	B09		B09	-15	-9	
3-42-0-V	VOID	38.5	B09	B09	B09	-15	-9	
2-24-0-AA	CARGO HOLD	112.2	B09	B09	B09	-15	-9	
2-35-1-F	FUEL TANK	127.6	B09		B09	-15	-9	
3-42-1-Q	POTABLE WATER EQPT RM	116.6	B09	B09	B10	-10	-8	
(none)	(weather bulkhead)	40.6	B09	H03		0	0	
(none)	(weather bulkhead)	127.6	B09	H03		0	0	
(none)	(weather bulkhead)	2.1	B09	H03		0	0	
(none)	(weather bulkhead)	6.6	B09	H03		0	0	
(none)	(weather overhead)	126.4	D06			0	0	

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 3-35-2-W BALLAST TANK

CUI: W (Water Tank (empty))

---

o GEOMETRY

Compartment Height (ft):	14.5	Vent Area (sq in):	0
Deck Area (sq ft):	124.1	Avg. Vent Ht.(in):	0

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 4 (Compartment Burnout (CBO))
Frequency of Acceptable Loss: 1 per 8 ship years

o FIRE DETECTION

	IN PORT	AT SEA
Percent of Time Monitored:	0	0
Estimated Time to Detection (min):	16	16

AUTOMATIC DETECTION SYSTEMS:
None

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
None
Hose Reels:
None
Fire Main Stations:
None

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	99	99	99
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	99	99	99

Frequency of Established Burning (fires/comp/year): 0.0004

o FUEL LOADS

Cellulosics(psf):	0.00	Plastics(psf):	0.00	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	0		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 16 (Very low density storage)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.0010
Maximum Heat Release Rate, MAXIMUM Q (kW): 0

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	999	999	999
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.0005	0.0005	0.0005

BARRIER FIRE SAFETY SUMMARY

Compartment: 3-35-2-W BALLAST TANK

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness
3-24-0-V	VOID	35.0	B09	B09	B09	-15	-9	
3-35-0-V	VOID	40.6	B09		B09	-15	-9	
3-42-0-V	VOID	37.8	B09	B09	B09	-15	-9	
2-24-0-AA	CARGO HOLD	110.0	B09	B09	B09	-15	-9	
2-35-2-F	FUEL TANK	127.6	B09		B09	-15	-9	
3-42-0-Q	MACHINE SHOP	114.4	B09	B09	B10	-10	-8	
(none)	(weather bulkhead)	40.6	B09	H03		0	0	
(none)	(weather bulkhead)	127.6	B09	H03		0	0	
(none)	(weather bulkhead)	2.1	B09	H03		0	0	
(none)	(weather bulkhead)	6.6	B09	H03		0	0	
(none)	(weather overhead)	124.1	D06			0	0	

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 3-81-1-W GRAY WTR HOLDING TNK

CUI: W (Water Tank (empty))

---

o GEOMETRY

Compartment Height (ft):	4.5	Vent Area (sq in):	0
Deck Area (sq ft):	36.3	Avg. Vent Ht.(in):	0

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 4 (Compartment Burnout (CBO))
Frequency of Acceptable Loss: 1 per 8 ship years

o FIRE DETECTION

FIRE DETECTION	IN PORT	AT SEA
Percent of Time Monitored:	0	0
Estimated Time to Detection (min):	16	16

AUTOMATIC DETECTION SYSTEMS:
None

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
None
Hose Reels:
None
Fire Main Stations:
None

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	99	99	99
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	99	99	99

Frequency of Established Burning (fires/comp/year): 0.0004

o FUEL LOADS

Cellulosics(psf): 0.00 Plastics(psf): 0.00 Liquids(gals): 0
Fuel Stack Height(%): NA Deck Area Occupied(%): 0

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 16 (Very low density storage)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.0010
Maximum Heat Release Rate, MAXIMUM Q (kW): 0

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	999	999	999
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.0005	0.0005	0.0005

BARRIER FIRE SAFETY SUMMARY

Compartment: 3-81-1-W GRAY WTR HOLDING TNK

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness
3-79-0-V	VOID	32.4	B09		B09	-15	-9	
3-79-0-V	VOID	22.5	B09		B09	-15	-9	
3-79-1-F	FUEL SERVICE TANK	32.9	B09		B09	-15	-9	
(none)	(weather bulkhead)	22.5	B09	H03		0	0	
3-79-0-Q	PUMP ROOM	36.2	D04			0	0	

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 3-0-0-V FOREPEAK

CUI: W (Water Tank (empty))

o GEOMETRY

Compartment Height (ft):	8.5	Vent Area (sq in):	0
Deck Area (sq ft):	27.8	Avg. Vent Ht.(in):	0

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 4 (Compartment Burnout (CBO))
Frequency of Acceptable Loss: 1 per 8 ship years

o FIRE DETECTION

FIRE DETECTION	IN PORT	AT SEA
Percent of Time Monitored:	0	0
Estimated Time to Detection (min):	16	16

AUTOMATIC DETECTION SYSTEMS:
None

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
None
Hose Reels:
None
Fire Main Stations:
None

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	99	99	99
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	99	99	99

Frequency of Established Burning (fires/comp/year): 0.0004

o FUEL LOADS

Cellulosics(psf):	0.00	Plastics(psf):	0.00	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	0		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 16 (Very low density storage)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.0010
Maximum Heat Release Rate, MAXIMUM Q (kW): 0

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	999	999	999
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.0005	0.0005	0.0005

BARRIER FIRE SAFETY SUMMARY

Compartment: 3-0-0-V FOREPEAK

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness
2-4-1-A	CHAIN LKR	27.2	B09		B09	-15	-9	
2-4-1-A	CHAIN LKR	25.6	B09		B09	-15	-9	
2-4-2-A	CHAIN LKR	25.6	B09		B09	-15	-9	
2-4-2-A	CHAIN LKR	27.2	B09		B09	-15	-9	
3-6-0-E	BOW THRUSTER ROOM	23.8	B09	B09	B09	-15	-9	
3-6-0-E	BOW THRUSTER ROOM	23.8	B09	B09	B09	-15	-9	
(none)	(weather bulkhead)	86.0	B10	H03		0	0	
(none)	(weather bulkhead)	86.0	B10	H03		0	0	
3-4-0-V	VOID	9.0	D04			0	0	
1-0-0-Q	BOATSWAIN STRM	27.8	D04			0	0	

COMPARTMENT FIRE SAFETY SUMMARY

Compartment: 2-44-0-W FRESH WATER TANK

CUI: W (Water Tank (empty))

o GEOMETRY

Compartment Height (ft):	7.5	Vent Area (sq in):	0
Deck Area (sq ft):	88.4	Avg. Vent Ht.(in):	0

o FIRE SAFETY OBJECTIVES

Magnitude of Acceptable Loss: 4 (Compartment Burnout (CBO))
Frequency of Acceptable Loss: 1 per 8 ship years

o FIRE DETECTION

FIRE DETECTION	IN PORT	AT SEA
Percent of Time Monitored:	0	0
Estimated Time to Detection (min):	16	16

AUTOMATIC DETECTION SYSTEMS:
None

o FIXED AND MANUAL SUPPRESSION

FIXED SYSTEMS INSTALLED:
None
MANUAL EQUIPMENT AVAILABLE:
Portable Extinguishers:
None
Hose Reels:
None
Fire Main Stations:
None

o PROBABILITY OF FLAME TERMINATION

	EB	TBAR	DBAR
By Self Termination (%):	99	99	99
By Fixed Suppression Systems (%):	0	0	0
By Manual Suppression Equipment (%):	99	99	99

Frequency of Established Burning (fires/comp/year): 0.0004

o FUEL LOADS

Cellulosics(psf):	0.00	Plastics(psf):	0.00	Liquids(gals):	0
Fuel Stack Height(%):	NA	Deck Area Occupied(%):	0		

o FIRE GROWTH MODEL, RATES AND FRI TIMES

Fire Growth Model: 16 (Very low density storage)

Pre-FRI Fire Growth Rate, ALPHA (kW/sq sec): 0.0010
Maximum Heat Release Rate, MAXIMUM Q (kW): 0

	XRAY	YOKE	ZEBRA
FRI Times|EB (min):	999	999	999
Post-FRI Heat Release Rates, POST-FRI Q (kW):	0.0005	0.0005	0.0005

BARRIER FIRE SAFETY SUMMARY

Compartment: 2-44-0-W FRESH WATER TANK

Barrier materials are listed below according to this convention:
<1> = Facing Material for this compartment
<2> = Material of watertight core or weather bulkhead
<3> = Facing Material for adjoining compartment

Barriers (Adjoining Compartment IDs and Names)		Area sqft	Materials <1>	<2>	<3>	Adjust T	D	Door/Hatch Readiness
3-42-0-Q	MACHINE SHOP	81.0	B09		B10	-10	-8	
3-42-0-Q	MACHINE SHOP	49.5	B09		B10	-10	-8	
3-42-0-Q	MACHINE SHOP	64.5	B09		B10	-10	-8	
3-42-1-Q	POTABLE WATER EQPT RM	36.0	B09		B10	-10	-8	
3-42-1-Q	POTABLE WATER EQPT RM	37.5	B09		B10	-10	-8	
3-47-1-Q	ENGRS STRM	19.5	B09		B10	-10	-8	
3-47-1-Q	ENGRS STRM	12.0	B09		B09	-15	-9	
3-42-0-V	VOID	88.4	D04			0	0	
3-42-0-Q	MACHINE SHOP	88.4	D04			0	0	

Appendix D
FIRE SAFETY ANALYSIS RESULTS

The detailed results of the fire safety analysis of the U.S. Coast Guard Coastal Buoy Tender Replacement (WLM (R)) are tabulated in Tables D.1 through D.5. Table D.1 lists the relative loss factors (RLF) for all compartments with a RLF > 0.0 for the baseline data set.

Tables D.2 through D.5 lists the RLF for all compartments with a RLF > 0.0 for the analysis of nine alternative data sets. These tables are organized to facilitate a comparison of worst case results of the alternative data sets for each of the following scenarios:

- Table D.2 - Scenario 1: I, A & M, XRAY, In Port
- Table D.3 - Scenario 4: I & A, XRAY, In Port
- Table D.4 - Scenario 7: I & M, XRAY, In Port
- Table D.5 - Scenario 10: I Only, XRAY, In Port

Note, results for the other eight scenarios (scenarios 2, 5, 8, & 11 for YOKE, In Port and scenarios 3, 6, 9, & 12 for YOKE, At Sea) were analyzed to verify they did not represent worst case.

The nine alternatives studied are summarized in the following list:

- Alternative #1: Reduce Percent Monitored
- Alternative #2: Remove All Insulation
- Alternative #3: Assume All Windows Lost
- Alternative #4: Remove One Engine Room Automated Fire Protection System
- Alternative #5: Remove Derating of Bulkhead Between Chart Room and Emergency Generator Room
- Alternative #6: Add AFFF System to Emergency Generator Room
- Alternative #7: Combine Alternatives #4 and #6
- Alternative #8: All T/D Adjust Values to -30%
- Alternative #9: Combine Alternatives #1, #2, #3, #4, and #8

Attachment D.1 is a detailed explanation of baseline and alternative data sets. Attachment D.2 contains an explanation of the three standard and nine non-standard scenarios utilized in SAFE to conduct a comprehensive fire safety analysis.

Attachment D.1
BASELINE AND ALTERNATIVE DATA SETS

Baseline and Alternative data sets are the two types of data sets considered in a comprehensive fire safety analysis using SAFE. The following is an explanation of these data sets:

BASELINE: This data set represents the characteristics of the ship in the "as is" condition that are pertinent to the determination of fire safety compared to pre-established fire safety objectives for flame movement. These characteristics include the thermal and physical characteristics of bulkheads and decks, fuel loads in each compartment, installed and portable fire detection and suppression equipment, probabilities of flame termination due to the ship's passive, automated and manual fire protection, and probabilities that barriers will prevent a thermal and/or durability failure. The ship is assumed to be in its normal operating configuration with a full crew complement and without enemy or self-inflicted (arson) damage.

ALTERNATIVE: An alternative data set is the baseline data set modified to reflect a hypothetical change to the ship that potentially affects its performance as a fire safety system. Note changing one characteristic may affect other characteristics or associated probabilities; it is critically important that all affected characteristics and probabilities be changed to accurately model an alternative fire protection feature.

The SAFE User Manual, Reference D, contains additional details concerning baseline and alternative data sets.

Attachment D.2
STANDARD AND NON-STANDARD SCENARIOS

Standard and Non-Standard Scenarios are utilized in SAFE to perform a complete fire safety analysis on the ship's baseline or alternative data sets. The following is an explanation of these scenarios:

STANDARD SCENARIOS			
Scenario #	1	2	3
Readiness Location Configuration	X-RAY IN-PORT I, A & M	YOKE IN-PORT I, A & M	YOKE AT-SEA I, A & M
NON-STANDARD SCENARIOS			
Scenario #	4	5	6
Readiness Location Configuration	X-RAY IN-PORT I & A	YOKE IN-PORT I & A	YOKE AT-SEA I & A
Scenario #	7	8	9
Readiness Location Configuration	X-RAY IN-PORT I & M	YOKE IN-PORT I & M	YOKE AT-SEA I & M
Scenario #	10	11	12
Readiness Location Configuration	X-RAY IN-PORT I	YOKE IN-PORT I	YOKE AT-SEA I

"XRAY" and "YOKE" refer to a particular damage control material condition of readiness in effect on the ship at the beginning of running the probabilistic model. These readiness conditions are defined in Naval Ships Technical Manual, Chapter 079. They represent degrees of "tightness" against flooding and fire by requiring designated access fittings and other closures to be closed. XRAY permits more doors/hatches to be open than YOKE.

"In-Port" or "At-Sea" represents the location of the ship during the probabilistic model run which is indicative of probable manning levels, percent time monitored (therefore time to detection), and operating machinery.

"I", "A" & "M" refer to the three lines of defense against the spread of fire. "I" represents the passive fire protection inherent in the ship's design. For example, the compartmentation, bulkhead and deck construction materials, and the distribution and type of fuel load in each compartment determine the likelihood that a fire will terminate Itself without intervention from the crew or by installed automatic/automated fire protection

systems. "A" represents the likelihood that an Automated fire protection system will extinguish the fire before full room involvement occurs in a given compartment. AFFF sprinkler systems, Halon 1301 total flooding systems, and aqueous potassium carbonate fire extinguishing systems serving Galley stoves are examples of automated systems typically installed in Coast Guard Cutters. "M" represents the likelihood that the crew will Manually extinguish the fire before full room involvement conditions are reached in a given compartment using the installed and portable fire protection systems such as the fire main and/or portable CO_2 and PKP fire extinguishers. SAFE has the ability to evaluate each of these lines of defense separately or collectively.

Table D.1 Relative Loss Factors (RLF) Scenarios 1-12
Baseline Data Set

Plan ID	Compartment Name	CUI	Scenario 1	Scenario 2-3	Scenario 4	Scenario 5-6	Scenario 7	Scenario 8-9	Scenario 10	Scenario 11-12
	Run No.		6-2	6-3/6-4	6-5	6-6/6-7	6-8	6-9/6-10	6-11	6-12/6-13
1-6-3-Q	Paint Locker	K	0.41	0.07	0.84	0.08	0.52	0.07	1.09	0.08
02-61-0-C	Chart Room	C	0.38	0.33	0.97	0.77	0.89	0.54	3.08	1.22
02-70-0-Q	Stack	TU	0.21	0.21	0.46	0.50	0.60	0.44	1.65	0.88
1-70-1-Q	Uptake	TU	0.16	0.17	0.29	0.32	0.43	0.43	0.73	0.72
02-68-2-E	Emergency Generator Room	QE	0.16	0.16	0.31	0.32	0.49	0.40	1.26	0.89
02-52-0-C	Pilothouse	C	0.15	0.15	0.38	0.37	0.23	0.23	0.68	0.61
1-61-0-L	Mess Room	LL	0.15	0.12	0.35	0.34	0.61	0.31	1.56	1.24
1-76-2-Q	Scullery	QG	0.10	0.06	0.19	0.10	0.55	0.16	1.14	0.35
3-6-0-E	Bow Thruster Room	EM	0.09	0.00	0.15	0.00	0.12	0.00	0.20	0.00
1-61-2-Q	Galley	QG	0.06	0.07	0.10	0.13	0.25	0.18	0.42	0.39
1-6-2-Q	ATON Shop	QS	0.05	0.00	0.10	0.00	0.07	0.00	0.13	0.00
3-88-0-E	Propulsion Thruster Room	QA	0.05	0.05	0.11	0.09	0.14	0.13	0.36	0.33
02-68-1-Q	Battery Locker	AG	0.04	0.04	0.05	0.05	0.04	0.04	0.05	0.05
3-52-0-C	Engineering Control Center	C	0.04	0.04	0.07	0.07	0.20	0.20	0.35	0.36
3-61-0-E	Main Engine Room	EM	0.04	0.04	0.05	0.04	0.49	0.48	0.76	0.72
01-50-0-C	Buoy Deck Control Room	C	0.03	0.02	0.09	0.05	0.06	0.02	0.34	0.05
3-15-0-E	Hydraulic Equipment Room	QA	0.03	0.00	0.06	0.00	0.03	0.00	0.08	0.00
3-57-1-Q	Elec Shop	QS	0.02	0.02	0.05	0.05	0.12	0.12	0.29	0.29
3-79-0-Q	Pump Room	QA	0.02	0.02	0.04	0.04	0.11	0.11	0.21	0.21
02-61-2-Q	PFD Locker	AG	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
02-61-1-Q	PFD Locker	AG	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
1-0-0-Q	Boatswain Locker	AG	0.01	0.02	0.02	0.03	0.01	0.02	0.02	0.03
01-70-1-Q	Boat Locker	AG	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.02
1-6-1-Q	Service Locker	QS	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1-79-1-L	Enlisted SR (4)	L5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-24-0-AA	Cargo Hold	AA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Compartments listed have MAL of 1-3 and RLF > 0.0000 in Scenario 1

See Attachment D.2 for description of Scenarios 1-12

Table D.2 Relative Loss Factors (RLF) Scenario 1
Baseline and Alternative Data Sets

	Compartment Name	CUI	Baseline	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7	Alt 8	Alt 9
Plan ID	Run No.		6-2	6M-26	6M-30	6M-34	6M-66	6M-42	6M-46	6M-50	6M-58	6M-62
1-6-3-Q	Paint Locker	K	0.41	0.45	0.45	0.41	0.41	0.41	0.41	0.41	0.38	0.48
02-61-0-C	Chart Room	C	0.38	0.42	0.54	0.40	0.57	0.34	0.25	0.44	0.35	0.96
02-70-0-Q	Stack	TU	0.21	0.22	0.23	0.24	0.38	0.21	0.15	0.32	0.21	0.42
1-70-1-Q	Uptake	TU	0.16	0.17	0.23	0.21	0.28	0.16	0.12	0.23	0.20	0.57
02-68-2-E	Emergency Generator Room	QE	0.16	0.17	0.20	0.18	0.21	0.15	0.02	0.02	0.20	0.33
02-52-0-C	Pilothouse	C	0.15	0.26	0.40	0.31	0.18	0.15	0.13	0.15	0.23	0.80
1-61-0-L	Mess Room	LL	0.15	0.18	0.15	0.15	0.38	0.15	0.15	0.38	0.17	0.45
1-76-2-Q	Scullery	QG	0.10	0.11	0.11	0.10	0.33	0.10	0.10	0.33	0.10	0.41
3-6-0-E	Bow Thruster Room	EM	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
1-61-2-Q	Galley	QG	0.06	0.08	0.07	0.06	0.15	0.06	0.05	0.15	0.08	0.32
1-6-2-Q	ATON Shop	QS	0.05	0.07	0.10	0.05	0.05	0.05	0.05	0.05	0.05	0.12
3-88-0-E	Propulsion Thruster Room	QA	0.05	0.06	0.06	0.05	0.07	0.05	0.05	0.07	0.06	0.11
02-68-1-Q	Battery Locker	AG	0.04	0.07	0.15	0.04	0.04	0.04	0.04	0.04	0.05	0.18
3-52-0-C	Engineering Control Center	C	0.04	0.04	0.04	0.04	0.12	0.04	0.04	0.12	0.04	0.15
3-61-0-E	Main Engine Room	EM	0.04	0.04	0.04	0.04	0.26	0.04	0.03	0.24	0.04	0.28
01-50-0-C	Buoy Deck Control Room	C	0.03	0.04	0.04	0.06	0.05	0.03	0.03	0.05	0.06	0.24
3-15-0-E	Hydraulic Equipment Room	QA	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
3-57-1-Q	Elec Shop	QS	0.02	0.02	0.02	0.02	0.07	0.02	0.02	0.07	0.02	0.10
3-79-0-Q	Pump Room	QA	0.02	0.02	0.02	0.02	0.05	0.02	0.02	0.05	0.02	0.06
02-61-1-Q	PFD Locker	AG	0.02	0.07	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.10
02-61-2-Q	PFD Locker	AG	0.02	0.07	0.10	0.02	0.02	0.02	0.02	0.02	0.03	0.22
1-0-0-Q	Boatswain Locker	AG	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.05
01-70-1-Q	Boat Locker	AG	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.04
1-6-1-Q	Service Locker	QS	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.07
1-79-1-L	Enlisted SR (4)	L5	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
2-24-0-AA	Cargo Hold	AA	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01

Compartments listed have MAL of 1-3 and RLF > 0.0000 in Baseline

Scenario 1=XRAY, In Port, "I," "A," and "M"

Table D.3 Relative Loss Factors (RLF) Scenario 4
Baseline and Alternative Data Sets

Plan ID	Compartment Name	CUI	Baseline	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7	Alt 8	Alt 9
	Run No		6-5	6M-27	6M-31	6M-35	6M-67	6M-43	6M-47	6M-51	6M-59	6M-63
02-61-0-C	Chart Room	QO	0.97	1.22	1.42	1.08	1.89	0.89	0.72	1.65	0.85	3.10
1-6-3-Q	Paint Locker	K	0.84	0.91	0.90	0.84	0.84	0.84	0.84	0.84	0.74	0.90
02-70-0-Q	Stack	TU	0.46	0.54	0.57	0.56	1.01	0.46	0.37	0.92	0.40	1.10
02-52-0-C	Pilothouse	C	0.38	0.70	1.05	1.09	0.49	0.38	0.31	0.43	0.61	3.31
1-61-0-L	Mess Room	LL	0.35	0.48	0.34	0.36	0.95	0.35	0.35	0.95	0.41	1.21
02-68-2-E	Emergency Generator Rm	QE	0.31	0.38	0.44	0.40	0.49	0.29	0.02	0.03	0.42	0.98
1-70-1-Q	Uptake	TU	0.29	0.32	0.57	0.55	0.48	0.29	0.22	0.41	0.39	1.52
1-76-2-Q	Scullery	QG	0.19	0.23	0.20	0.19	0.67	0.19	0.19	0.67	0.20	0.97
3-6-0-E	Bow Thruster Room	QE	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.16	0.16
3-88-0-E	Propulsion Thruster Rm	QA	0.11	0.13	0.13	0.11	0.17	0.11	0.11	0.17	0.12	0.33
1-6-2-Q	ATON Shop	QS	0.10	0.13	0.16	0.10	0.10	0.10	0.10	0.10	0.10	0.20
1-61-2-Q	Galley	QG	0.10	0.16	0.12	0.10	0.26	0.10	0.10	0.26	0.15	0.77
01-50-0-C	Buoy Deck Control Room	C	0.09	0.12	0.15	0.24	0.21	0.09	0.09	0.21	0.24	1.44
3-52-0-C	Engineering Control Ctr	C	0.07	0.08	0.07	0.08	0.21	0.08	0.07	0.21	0.10	0.39
3-15-0-E	Hydraulic Equipment Rm	QA	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.07
02-68-1-Q	Battery Locker	AG	0.05	0.12	0.23	0.05	0.05	0.05	0.05	0.05	0.08	0.29
3-57-1-Q	Elec Shop	QS	0.05	0.05	0.05	0.05	0.17	0.05	0.05	0.17	0.04	0.18
3-61-0-E	Main Engine Room	EM	0.05	0.05	0.05	0.05	0.39	0.05	0.04	0.36	0.05	0.49
3-79-0-Q	Pump Room	QA	0.04	0.04	0.04	0.04	0.10	0.04	0.04	0.10	0.04	0.13
02-61-1-Q	PFD Locker	AG	0.02	0.13	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.20
02-61-2-Q	PFD Locker	AG	0.02	0.12	0.15	0.02	0.02	0.02	0.02	0.02	0.03	0.47
1-0-0-Q	Boatswain Locker	AG	0.02	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.07
01-70-1-Q	Boat Locker	AG	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.11
1-6-1-Q	Service Locker	QS	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.16
1-79-1-L	Enlisted SR (4)	L5	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06
2-24-0-AA	Cargo Hold	AA	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01

Compartments listed have MAL of 1-3 and RLF > 0.0000 in Baseline

Scenario 4=XRAY, In Port, “I”and “A”

Table D.4 Relative Loss Factors (RLF) Scenario 7
Baseline and Alternative Data Sets

Plan ID	Compartment Name	CUI	Baseline	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7	Alt 8	Alt 9
	Run No.		6-8	6M-28	6M-32	6M-36	6M-68	6M-44	6M-48	6M-52	6M-60	6M-64
02-61-0-C	Chart Room	C	0.89	0.97	1.25	0.92	0.89	0.82	0.89	0.89	0.87	1.50
1-61-0-L	Mess Room	LL	0.61	0.70	0.55	0.61	0.61	0.61	0.61	0.61	0.63	0.73
02-70-0-Q	Stack	TU	0.60	0.62	0.58	0.54	0.60	0.60	0.60	0.60	0.51	0.63
1-76-2-Q	Scullery	QG	0.55	0.61	0.57	0.55	0.55	0.55	0.55	0.55	0.55	0.68
1-6-3-Q	Paint Locker	K	0.52	0.56	0.57	0.52	0.52	0.52	0.52	0.52	0.48	0.58
3-61-0-E	Main Engine Room	EM	0.49	0.49	0.50	0.50	0.49	0.49	0.49	0.49	0.50	0.54
02-68-2-E	Emergency Generator Room	QE	0.49	0.54	0.61	0.61	0.49	0.48	0.49	0.49	0.68	0.76
1-70-1-Q	Uptake	TU	0.43	0.44	0.72	0.57	0.43	0.43	0.43	0.43	0.63	0.89
1-61-2-Q	Galley	QG	0.25	0.28	0.26	0.25	0.25	0.25	0.25	0.25	0.38	0.50
02-52-0-C	Pilothouse	C	0.23	0.35	0.68	0.54	0.23	0.23	0.23	0.23	0.35	1.17
3-52-0-C	Engineering Control Center	C	0.20	0.22	0.23	0.20	0.20	0.20	0.20	0.20	0.21	0.26
3-88-0-E	Propulsion Thruster Room	QA	0.14	0.16	0.18	0.14	0.14	0.14	0.14	0.14	0.15	0.21
3-6-0-E	Bow Thruster Room	EM	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.13
3-57-1-Q	Elec Shop	QS	0.12	0.12	0.13	0.12	0.12	0.12	0.12	0.12	0.07	0.16
3-79-0-Q	Pump Room	QA	0.11	0.12	0.12	0.11	0.11	0.11	0.11	0.11	0.11	0.13
1-6-2-Q	ATON Shop	QS	0.07	0.09	0.12	0.07	0.07	0.07	0.07	0.07	0.07	0.14
01-50-0-C	Buoy Deck Control Room	C	0.06	0.08	0.13	0.12	0.06	0.06	0.06	0.06	0.13	0.37
02-68-1-Q	Battery Locker	AG	0.04	0.08	0.23	0.04	0.04	0.04	0.04	0.04	0.05	0.26
3-15-0-E	Hydraulic Equipment Room	QA	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
02-61-2-Q	PFD Locker	AG	0.02	0.08	0.17	0.02	0.02	0.02	0.02	0.02	0.03	0.33
02-61-1-Q	PFD Locker	AG	0.02	0.08	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.12
1-0-0-Q	Boatswain Locker	AG	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.05
01-70-1-Q	Boat Locker	AG	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.05
1-6-1-Q	Service Locker	QS	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.09
1-79-1-L	Enlisted SR (4)	L5	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
2-24-0-AA	Cargo Hold	AA	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01

Compartments listed have MAL of 1-3 and RLF > 0.0000 in Baseline

Scenario 7=XRAY, In Port, “I”and “M”

Table D.5 Relative Loss Factors (RLF) Scenario 10
Baseline and Alternative Data Sets

Plan ID	Compartment Name	CUI	Baseline	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7	Alt 8	Alt 9
	Run No.		6-11	6M-29	6M-33	6M-37	6M-69	6M-45	6M-49	6M-53	6M-61	6M-65
02-61-0-C	Chart Room	C	3.08	3.57	4.23	3.18	3.08	2.93	3.08	3.08	2.43	4.89
02-70-0-Q	Stack	TU	1.65	1.87	1.69	1.33	1.65	1.65	1.65	1.65	1.02	1.63
1-61-0-L	Mess Room	LL	1.56	1.97	1.40	1.57	1.56	1.56	1.56	1.56	1.50	2.08
02-68-2-E	Emergency Generator Room	QE	1.26	1.62	1.65	1.73	1.26	1.23	1.26	1.26	1.93	2.40
1-76-2-Q	Scullery	QG	1.14	1.40	1.22	1.14	1.14	1.14	1.14	1.14	1.15	1.66
1-6-3-Q	Paint Locker	K	1.09	1.16	1.15	1.09	1.09	1.09	1.09	1.09	0.95	1.11
3-61-0-E	Main Engine Room	EM	0.76	0.78	0.82	0.82	0.76	0.76	0.76	0.76	0.79	0.95
1-70-1-Q	Uptake	TU	0.73	0.77	1.85	1.51	0.73	0.73	0.73	0.73	1.29	2.38
02-52-0-C	Pilothouse	C	0.68	1.11	2.04	2.32	0.68	0.67	0.68	0.68	1.19	4.91
1-61-2-Q	Galley	QG	0.42	0.55	0.47	0.42	0.42	0.42	0.42	0.42	0.72	1.20
3-88-0-E	Propulsion Thruster Room	QA	0.36	0.45	0.59	0.36	0.36	0.36	0.36	0.36	0.38	0.73
3-52-0-C	Engineering Control Center	C	0.35	0.41	0.52	0.37	0.35	0.37	0.35	0.35	0.38	0.70
01-50-0-C	Buoy Deck Control Room	C	0.34	0.47	0.87	0.60	0.34	0.34	0.34	0.34	0.72	2.38
3-57-1-Q	Elec Shop	QS	0.29	0.29	0.26	0.29	0.29	0.29	0.29	0.29	0.17	0.30
3-79-0-Q	Pump Room	QA	0.21	0.24	0.22	0.21	0.21	0.21	0.21	0.21	0.21	0.28
3-6-0-E	Bow Thruster Room	EM	0.20	0.21	0.20	0.20	0.20	0.20	0.20	0.20	0.21	0.22
1-6-2-Q	ATON Shop	QS	0.13	0.16	0.20	0.13	0.13	0.13	0.13	0.13	0.13	0.23
3-15-0-E	Hydraulic Equipment Room	QA	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
02-68-1-Q	Battery Locker	AG	0.05	0.14	0.35	0.05	0.05	0.05	0.05	0.05	0.08	0.43
02-61-2-Q	PFD Locker	AG	0.02	0.18	0.24	0.02	0.02	0.02	0.02	0.02	0.03	0.74
02-61-1-Q	PFD Locker	AG	0.02	0.15	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.27
1-0-0-Q	Boatswain Locker	AG	0.02	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.07
01-70-1-Q	Boat Locker	AG	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.18
1-6-1-Q	Service Locker	QS	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.20
1-79-1-L	Enlisted SR (4)	L5	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09
2-24-0-AA	Cargo Hold	AA	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01

Compartments listed have MAL of 1-3 and RLF > 0.0000 in Baseline

Scenario 10=XRAY, In Port, "I" Only

Appendix E

FIRE PROTECTION DOCTRINE

The U.S. Coast Guard Coastal Buoy Tender Replacement (WLM(R)) Fire Protection Doctrine is organized into three parts: Part A contains the principles of fire science which are relevant to shipboard fire protection. Part B contains official policies and guidance promulgated by the Commandant, U.S. Coast Guard that pertain to firefighting on "small" cutters. For the purposes of this fire protection doctrine, "small" cutters are defined to be all cutters 65' and greater in length and less than 180' in length. The 175' WLM(R) considered in this report is largest "small" cutter in the Coast Guard fleet. Part C contains firefighting procedures and tactics for combating all classes of fires in all compartments in the WLM(R) class cutter. Specific procedures are provided for 15 individual compartments as well as in-port fires. Part C also contains information pertinent to firefighting in the WLM(R) such as:

- Compartmentation - Inboard and outboard profile and deck plan views of the WLM(R) are shown. In addition, location of particularly hazardous fuel loads are noted.
- Mechanical and electrical isolation details are provided for various systems and equipment.
- Ventilation and smoke control details are provided.
- Information concerning the fire and smoke detection system is provided.
- Specific information concerning installed and portable firefighting equipment is provided.

The following is an index for this appendix: Page

Fire Protection Doctrine - Part A

Principles of Fire Science

Table of Contents

Fire Protection Doctrine - Part A

Principles of Fire Science

I. Purpose

The purpose of this fire protection doctrine is to provide useful information pertinent to fire science (Part A), guidance promulgated by Commandant for firefighting on Coast Guard Cutters (Part B), and tactical firefighting procedures for each class of fire likely to be encountered, inport and underway (Part C). Part A of this doctrine applies to all Coast Guard Cutter Classes. Part B applies specifically to either "small" or "large" Coast Guard Cutter Classes. Small Cutters are defined, for the purposes of firefighting doctrine applicability, to be all cutter classes ranging in size from 65' WYTL Harbor Tugboats to 175' WLM (R) Coastal Buoy Tenders inclusive. Large Cutters are defined, for the purposes of firefighting doctrine applicability, to be all cutter classes ranging in size from 180' WLB Ocean-going Buoy Tenders to 399' WAGB Polar Icebreakers inclusive. Part C is Coast Guard Cutter Class specific and should be individually tailored to suit each ship in the class to account for minor differences. A complete fire protection doctrine for a cutter is therefore composed of three parts.

II. Shipboard Fire Protection

A. Philosophy

The guiding design philosophy of shipboard fire protection embraces a series of steps beginning with prevention and continuing in sequence through detection, confinement, control, extinguishment and finally post-extinguishment. It would be ideal if fires could be prevented from occurring in the first place, therefore considerable effort is made to prevent fires. If an unwanted fire does occur, it is desirable to detect the fire as early as possible and before the fire has a chance to grow. Detection can be accomplished with installed smoke, heat and flame detectors or the crew can detect the presence of smoke or fire. Once a fire is detected, the approach is to contain or isolate the fire to the "room of origin". If this is successful, the damage will be minimized. In some cases the fire will spread to involve other compartments through poorly designed (or maintained) bulkheads or open access fittings. In either event, the next step is to extinguish the fire. Extinguishment can be accomplished manually or with an automated, fixed fire protection system. The post-extinguishment step includes restoration of ship's systems to enable continuation of the ship's mission.

B. Fundamental Concepts of Fire

In a ship, fuels are present in solid, liquid and gaseous forms. Solid fuels include paper products, clothing, furniture, plastics and other common "ash-producing" substances. They are capable of smoldering for hours before bursting into visible flames. Plastic fuels (polyethylene, nylon, vinyls, etc.) usually produce higher burning rates and a higher heat content per unit weight than cellulosic fuels. In addition, plastics usually burn with extremely dense smoke and produce toxic gases such as carbon monoxide, hydrogen chloride and phosgene gas. Flammable liquids such as lube oil, hydraulic oil, diesel fuel,

JP-5, paints and solvents are usually found in engineering spaces and are often contained under pressure. Pound for pound, flammable liquids produce 2.5 times more heat than wood, and they release this heat 3 to 10 times faster. When flammable liquids spill, or worse, spray under pressure on a hot surface, the resulting fire burns with tremendous intensity. Many of the major conflagrations on ships are a result of flammable liquid spray fires in the engine room. There are both natural and manufactured flammable gases. Those commonly found on board ship include acetylene, propane, and butane. Gases, like flammable liquids, usually produce visible flames and will not smolder.

1. Fire Tetrahedron

Combustion or rapid oxidation describes a process in which a fuel pyrolizes or turns into a vapor and mixes with oxygen at a high rate of speed; heat and light, visibly seen as flames, are by-products of this process. The heat generated by combustion travels in all directions including back toward the fire which in turn pyrolizes more fuel and thus a chain reaction is established. Fuel, heat and oxygen are thus required for the existence of fire as well as the chain reaction process described. The fire tetrahedron, shown in Figure A-1, is a graphic representation of the combustion process. If any of the four faces of the tetrahedron are removed, the fire will be extinguished.

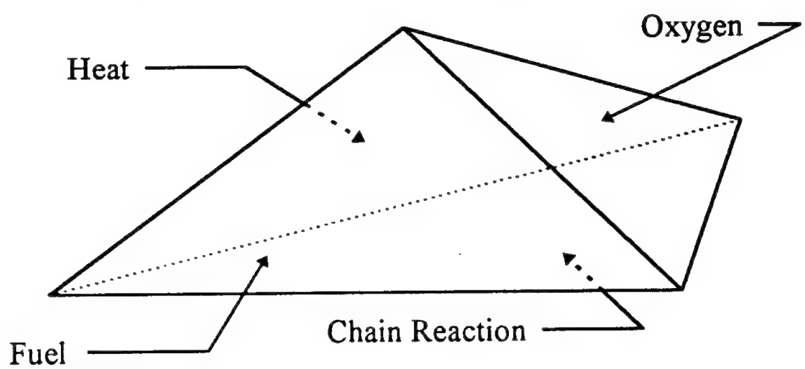


Figure A.1 The Fire Tetrahedron

2. Classification of Fire

Fires are grouped into four classes according to the type of fuel as shown in Table A-1. Sometimes due to the presence of multiple fuel types a combination of classes of fire will occur. Electrical fires, for example, almost always involve a solid or liquid fuel as well.

TABLE A.1 CLASSES OF FIRE

Class	Fuel
A	Solid Fuels
B	Flammable Liquids or Gases
C	Electrical
D	Combustible Metals

3. Extinguishing Agents

An extinguishing agent operates by removing one or more faces of the fire tetrahedron using one of the following four methods:

- Cooling. This is a direct attack on the heat face of the tetrahedron. The goal is to reduce the temperature of the fuel below its ignition temperature.
- Smothering. This is an attack on the edge of the tetrahedron where the fuel and oxygen meet. The action is to separate the fuel from the oxygen.
- Oxygen Dilution. This is an attack on the oxygen face where the goal is to reduce the oxygen content below that necessary to sustain combustion.
- Chain Reaction Breaking. The goal here is to interrupt the chain reaction long enough for the fuel to cool below its ignition point.

There are six fire extinguishing agents normally encountered in shipboard firefighting. These agents are in the form of liquids (3), gases (2) or solids (1). The choice of agent is based on the class of fire and the agents available to fight the fire. The following sections discuss the agents available, their advantages and disadvantages.

a) Liquid

By far the most common extinguishing agent is water. Salt or fresh water is very effective on class A fires while aqueous film-forming foam (AFFF) is effective against class B fires and deep seated class A fires. The advantage of using water is its inexhaustible supply; the disadvantage is that water conducts electricity and adversely affects the stability of the ship if too much accumulates. AFFF has persistence and will remain effective as a blanketing agent for several hours, but has to be washed from machinery after the fire is out. Aqueous potassium carbonate is primarily used to combat galley deep fat fryer fires and their exhaust systems.

b) Gas

Halon is a manufactured chlorofluorocarbon (CFC) and is extremely effective against all classes of fire. The advantages of Halon are that it is clean, non lethal (in concentrations sufficient to extinguish fire), non-conducting, and extremely fast in extinguishing fires. Like freon and other CFCs, it apparently damages the ozone in the atmosphere and is being phased out of production. CO_2 is an effective agent against class C fires and is non-conductive and non-corrosive. CO_2 is clean, effective, and environmentally acceptable, but it is lethal in quantities sufficient to extinguish fire.

c) Solid

Potassium bicarbonate powder (PKP) is the only dry chemical authorized for use in portable extinguishers on Coast Guard Cutters and Boats. PKP fire extinguishers are designed to be used on Class B fires. They may also be used on Class A fires, recognizing that they may have limited effectiveness. This agent is non-lethal and non-conducting but on the other hand it is corrosive to electronic equipment and difficult to clean up.

III. Prevention

There are four basic principles of fire prevention which should be observed routinely to reduce shipboard fire hazards.

A. Frequent Inspections

It is the responsibility of every crew member to prevent fires. Accordingly, the entire crew should be constantly alert to eliminate fire hazards. Fire hazards should be brought to the attention of the Commanding Officer/Officer-in-Charge who can take appropriate action.

B. Proper Stowage of Combustibles

Paint, flammable liquids, ordnance and munitions should only be stowed on board in spaces specifically designed for the purpose or on weather decks. These spaces will be protected with explosion proof lights, noncombustible shelving, fire detectors, and an automated total flooding fire protection system. Paint lockers, magazines and other spaces specifically designed for extremely flammable or explosive products are not generally found on small cutters.

C. Training and Education

Frequent fire drills and team training should be conducted so that in an emergency the crew will respond correctly and automatically. Education in the principles of fire science will permit the proper selection of a firefighting agent and equipment depending on the class of fire encountered. Training will permit the proper use of the firefighting equipment installed or available on board.

D. Enforcement of Fire Prevention Policies and Practices

The following policies and practices will minimize fire hazards and reduce the chances of uncontrolled growth if a fire should occur.

- Maintain flange shields on flammable liquid piping.
- Maintain proper covers on flammable liquid strainers.
- Keep sounding tube caps in place and isolation valves closed.
- Take immediate action to stop and repair all oil leaks.
- Keep ventilation ducts clean and free from oily residue.
- Keep bilges free of trash and oil.
- Do not allow unauthorized flammable materials on board.
- Do not stow combustible materials in voids or uptakes.
- Do not stow combustibles in direct contact with bulkheads and decks - allow for at least one foot stand-off distance.

- Perform preventive maintenance on firefighting equipment in accordance with authorized procedures. Ensure all interlocks work properly.
- Operate firefighting equipment in accordance with procedures established in this doctrine and other authorized documents.
- Maintain damage control closures and fittings in accordance with the authorized material condition of readiness.
- Comply with authorized tag-out procedures for electrical and mechanical equipment.

IV. Detection

There are two types of fire detectors: the installed smoke, heat and flame detectors found in berthing compartments, magazines, engine rooms, and other spaces, and the crew, who should be constantly vigilant to the presence of smoke or flames. A crew member has two basic duties to perform in the event that fire or smoke is detected: sounding the alarm, and making an effort to extinguish or at least contain the fire. The person discovering the fire should sound the alarm first then attempt to apply first aid. The crew member should attempt to extinguish the fire with the nearest available extinguisher that dispenses the appropriate firefighting agent if this first aid can be accomplished safely. If first aid is not immediately effective, the crew member should evacuate the space and contain the fire by closing the door to the compartment.

A. Equipment

Fire detectors sense, and initiate a signal in response to, heat, smoke, flame or some other indication of fire. The types of detectors that are in common use are discussed in the next section.

1. Smoke Detectors (products of combustion)

The smoke detector continuously samples the air for the products of combustion, specifically smoke particles. There are various types of smoke detector, the most common include the ionization and photoelectric types. Ionization detectors operate on the principle that smoke interferes with the flow of ionized particles created in the detector. The photoelectric type measures the amount of obscurity in a light beam created by the detector.

2. Heat-actuated Fire Detectors (fixed temperature, rate of rise)

The primary classes of heat-actuated devices are fixed-temperature detectors and rate-of-rise detectors. A fixed-temperature detector initiates an alarm when the temperature of the device reaches a pre-set value. Note the device itself has to reach this temperature - not just the air around it. This thermal lag is proportional to the rate of rise of the air temperature. Rate of rise detectors sense the rate at which the temperature is rising and sounds an alarm when this rate exceeds the allowable value. Rate of rise detectors will reset themselves, whereas fixed temperature detectors will not.

3. Flame Detectors (optical)

Flame detectors are designed to recognize certain characteristics of flames such as light intensity, flicker (pulsation) frequency and radiant energy levels. Flame detectors are not commonly found on board ship due to false alarms. For example arcs from welding, or light reflecting off the water's surface sometimes cause flickering which are misinterpreted by the detector. Electric light bulbs also tend to flicker if the ship is vibrating.

B. Operation

Detectors are designed to operate continuously with minimal maintenance and are inherently reliable. They are usually battery powered or wired for 110 volt electrical power. In general, on Coast Guard Cutters, detectors sound the alarm only, they do not automatically discharge a firefighting agent.

V. Confinement

The initial actions by the person who discovers a fire can make the difference between a controllable fire and one which threatens the life of the ship. Any crew member discovering a fire or an indication of fire must immediately sound the alarm. The report of a fire must reach the Officer of the Deck by whatever method available, such as messenger, telephone, announcing system, intercom, installed fire alarm system, or human voice. If the fire is small and appears capable of being controlled, then an initial attack can be attempted by personnel with little or no protection. The use of more than one portable extinguisher simultaneously is more effective than using them one at a time. If the fire is large, or if the compartment of origin is unknown, or if the fire is fed by a pressurized fuel source, then the initial actions should be to contain and isolate the fire. This can be accomplished by taking advantage of the design of the vessel (passive measures) and by isolating the fire from sources of fuel and oxygen (active measures). The following sections discuss these passive and active measures.

A. Passive Measures

Passive measures include features that are designed into the cutter that serve to inhibit fire growth.

1. Compartmentation

A ship is subdivided into compartments for several purposes, not the least of which is to provide barriers to fire, smoke, and flooding.

a) Barriers.

Barriers include the bulkheads, decks and overheads that define a compartment's boundaries. Watertight bulkheads are designed to resist both fire and flooding. Non-watertight joiner bulkheads serve a useful purpose to slow the spread of fire and smoke but are generally ineffective to prevent progressive flooding. Doors, windows and portholes are often open to provide ventilation and access for the crew; these must be

immediately closed in the event of fire or flooding to maximize the barriers' effectiveness. Some ships have specially designed bulkheads and decks to resist fire spread (e.g. boundaries enclosing engineering spaces). A fire zone boundary is a physical boundary designed to retard the passage of flame and smoke. Watertight bulkheads and decks may serve as fire zone boundaries along with other boundaries specifically designed to resist fire. In addition, joiner bulkheads may serve as a fire zone boundary even though there is a reduced degree of fire resistance compared to a specifically designated fire zone bulkhead/deck. These joiner bulkheads may serve as a fire zone boundary, provided there is physical integrity maintained from deck-to-deck. Any boundary in which the physical characteristics are maintained (i.e. no openings) can serve as a smoke boundary to prevent smoke spread. Openings can be protected to prevent smoke spread by installing smoke curtains or blankets/sheets.

b) Fuel Loading.

A fire cannot burn without fuel. Therefore if the fire can be isolated in a compartment that has minimal fuel loading, the fire will go out on its own. The distribution of the fuel loading is an important factor in fire growth. For example, if the fuel is stacked vertically (opposed to horizontally) the fire will grow more quickly for the same amount of fuel. Fire will also spread more quickly in bookcases with the glass doors open than with the doors closed. Simply closing the doors on bookcases before leaving the ship's office is a good example of how one can take advantage of the ship's passive fire protection features to prevent fire growth.

The type of fuel is a very important factor. There are two basic types of solid fuel: cellulosic and plastic. Cellulosic fuels are basically wood-based products such as paper, wood, and cotton. Plastics include a lot of the modern manufactured products such as polystyrene (liners in refrigerators), foams and vinyls (padding and upholstery used in cushions), and polyesters (clothing). Plastics, in general, have heat release rates that are five to ten times greater than cellulosics. Sleeping bags brought on board by the crew for example, may be five to ten times more hazardous than wool blankets.

2. Construction Materials

Non-flammable construction materials are normally specified in new construction. The crew is cautioned that decorative sheathing or paneling installed during habitability improvement projects should not include flammable materials. Likewise, if the cushions on the mess deck benches are reupholstered, the selection of materials should be in accordance with guidance on acceptable products and materials. This guidance should be obtained from the Naval Engineering Manual, COMDTINST M9000.6 (Series), or from the MLC (v) division.

B. Active Measures

Active measures include actions that the ship's crew can take to isolate and contain a fire.

1. Setting Material Condition ZEBRA

One of the most basic procedures in shipboard firefighting is setting material condition ZEBRA which is intended to close all doors and windows in all the barriers to a fire.

2. Securing Ventilation

Securing supply and exhaust ventilation fans and installing available covers over the inlet or exhaust will reduce the available oxygen to a fire. Positive ventilation should be provided where possible to spaces outside the smoke boundaries.

Active desmoking (e.g. positive ventilation to spaces outside smoke boundaries and desmoking during firefighting efforts) should be limited to fires involving class A materials. Refer to NSTM Chapter 555, Section 555-5.3.4C for additional guidance and details.

3. Securing Fuel

In a class B fire it is absolutely essential to secure the fuel to operating engines. Attempts to extinguish the fire will be frustrated until the source of the fuel is secured. Remote fuel shutoffs are provided outside the machinery space to safely secure the fuel supply. It should be noted that after securing the fuel supply the engine will continue to run for a short time to consume the in-line fuel.

4. Securing Electrical Power.

Securing the electrical power will extinguish a class C fire. Additional extinguishment efforts may be required if a class A or B fire is also involved. The fire pumps on most cutters are electrically operated. Therefore an alternate source of firefighting water pressure may be required in the event electrical power is secured.

VI. Extinguishment

A. Firefighting Equipment

The firefighting systems described below are installed on Coast Guard Cutters. Each has capabilities and limitations which must be understood by firefighting personnel to ensure quick and proper selection of equipment. Each cutter has a subset of these systems and it is important to know which systems/equipment are available for use. This specific information is located in Part C of the fire protection doctrine for each cutter. The following information is a basic introduction to firefighting equipment typically found on board Coast Guard Cutters. All personnel should read the following publications for more detailed information:

- Naval Ship's Technical Manuals (Chapters 555, 077 and 079 vol 1-3)
- Naval Engineering Manual (COMDTINST M9000.6 (Series))
- Surface Ship Survivability Manual (NWP 62-1 (Series))

1. Firemain System

The firemain system consists of installed piping to distribute water to fire stations located throughout the ship. This piping may be exposed to freezing temperatures, the weight of the water in the system would adversely affect stability, and operating the fire pumps without overboard reliefs would burn up the pumps, therefore this system is normally dry and has to be charged with water from an installed electric pump or a portable pump. The system is normally used to energize fire hoses for fighting class A fires or for the production of AFFF water mixture for class B fires. When a hose line attack is needed to attack a flammable liquid fire, water fog may be used (fog position on the Coast Guard vari-nozzle) as the primary extinguishing agent. However, the time required to fight the fire will be longer, more firefighters will be required, increased fire damage can be expected, and risk of reflash is greater than if AFFF were used.

2. Firehose and Nozzle

The standard hose used on Coast Guard Cutters is an orange colored, chlorosulfonated, polyethylene (hypolon), impregnated, double jacketed , synthetic rubber hose in two sizes - 1 1/2" and 2 1/2", and one length - 50 ft. The hose is configured with a brass male coupling on one end and a brass female coupling on the other. The male end always goes to the scene of the fire. The exposed brass threads on the male coupling are easily damaged which may prevent installation of a nozzle. Two lengths may be connected and the couplings should be hand tightened. The spanner wrench at the fire station should not be used for this purpose, this wrench should be used to loosen the connection between the fire station and the firehose. Fire stations are located on the cutter such that two hoses can be brought to bear in any compartment. This may require the installation of two lengths of fire hose on some fire stations.

The Coast Guard Vari-nozzle is manufactured by Akron Brass (style 3019) and Elkhart Brass (SFL-GN-95). It is designed for a 95 gpm flow rate and is used to produce AFFF with a style 2901 inline proportioner.

3. Portable Pumps

Portable pumps serve a dual purpose. First, they may be used to provide a source of firefighting water on the cutter itself or for another vessel in distress. The portable pump can serve as a backup to the installed electric pump or as the primary source in case the electric pump is unavailable. This is often the case in an engine room fire where most electric pumps are installed. Secondly, they can be used as a means of dewatering. Since a portable pump is driven by an internal combustion engine, it must be operated on the weather deck. The designation of portable pumps includes the rate in gallons per minute the pump is deigned to produce.

a) P-250 Mod 1 Pump

This pump is a portable, gasoline engine driven pump. It is designed for use in firefighting and dewatering operations. It will produce 250 gpm at 100 psi using two 1 1/2" hoses and one 2 1/2" eductor. For dewatering contaminated spaces, the P-250 pump can be used in conjunction with a peri-jet eductor; the pump can draw a suction directly

on uncontaminated spaces if the suction hose will reach the space from the weather deck. The peri-jet eductor is a venturi that is designed to discharge approximately two times the amount of water pumped through it. If the eductor discharge becomes blocked, the eductor will very quickly flood the compartment it is supposed to be dewatering. A careful and frequent check must be conducted to ensure the eductor is working satisfactorily.

b) CG P-1B Pump

These pumps are portable, lightweight, self contained pumps used for dewatering only. The CG P-1B will dewater at the rate of 120 gpm with a 10' suction lift and 20' discharge head.

c) CG P-5 Pump

The CG P-5 pump can be used for dewatering and limited firefighting and AFFF application at the rate of 200 gpm with a 10' suction lift.

4. Automated Fixed Flooding Systems

A class B fire in the engine room is capable of extremely rapid growth to major conflagration proportions in a matter of minutes if not seconds. Since it typically requires ten minutes or more for a ship to set Zebra, man repair parties, rig firehoses, and dress out a firefighting party in firefighting ensembles, an automated fixed flooding system may be installed to combat this type of problem. Magazines are usually protected by an automated fixed flooding system as well.

a) CO_2 System

Fixed CO_2 systems are installed in paint lockers, flammable liquid storerooms, and engine rooms. It is normally designed to totally flood the space and includes automatic shutdown of installed ventilation systems. The system normally includes a manually activated remote pull box, audible and visual alarms. If the space protected is normally occupied and there is a vertical exit to the weather deck, a 60 second discharge time delay is mandatory to permit evacuation of personnel since CO_2 is lethal in the concentrations required to extinguish fires. CO_2 is heavier than air and will persist in the protected space even if openings in the overhead are present.

b) Halon 1301 System

Halon 1301 is installed in the engine room since halon is extremely effective against class B fires and accidental discharge is non-lethal in the concentrations required to extinguish fires. However, if halon is ingested by internal combustion engines, or if halon is exposed to the fire itself for more than ten seconds, the byproducts from the combustion of halon are toxic to humans. Therefore the design of Halon 1301 total flooding systems include discharge times of less than ten seconds, and include automatic shutdown of internal combustion engines and ventilation equipment in the protected spaces. A 60 second time delay, visual and audible alarms, similar to CO_2 systems, are included in the design of Halon 1301 flooding systems to permit evacuation of the space before

discharging Halon. When it is released, Halon 1301 vaporizes to a colorless, odorless gas with a density approximately five times that of air. Halon concentrations between 5% and 7% are required to extinguish fires. Sufficient volume is provided to maintain this concentration for at least 15 minutes, therefore it is important to seal the protected space to prevent escape of the agent. In addition, two "shots" are usually provided that are capable of completely flooding the protected space twice. The second shot is designed to be used if the first shot is ineffective or in the event of a reflash.

c) Aqueous Film Forming Foam (AFFF)

AFFF is composed of synthetically produced materials similar to liquid detergents. For shipboard use, six parts of AFFF concentrate are mixed with 94 parts water. The bilge area in engine rooms may be protected by installed nozzles which distribute pre-mixed AFFF. AFFF, when proportioned with water provides three firefighting advantages: First, due to its low viscosity it quickly spreads over the surface of burning fuel, the aqueous film thus formed excludes air. Second, the foam layer prevents the escape of fuel vapors. Third, the water content of the foam provides a cooling effect.

AFFF is produced by mixing water with AFFF concentrate either by a fixed, balanced pressure foam proportioning unit or by using a portable 95 gpm in-line eductor (sometimes referred to as a pick-up tube) attached to one of the installed fire stations. AFFF can be applied from an installed AFFF hose reel with vari-nozzle, or from a separate fire plug fitted with portable in-line eductor and hose fitted with vari-nozzle, or from a fixed sprinkler system installed in the bilge area or the overhead.

d) Aqueous Potassium Carbonate

Aqueous potassium carbonate (APC) is used to extinguish burning cooking oil and grease in deep fat fryers and galley ventilation exhaust ducts. APC solution consists of 42.2% potassium carbonate and 57.8% water. When APC comes in contact with the burning surface, it generates a soap-like froth that excludes air from the surface of the grease or oil and thus extinguishes the fire.

5. Portable Fire Extinguishers

"First-aid" in the context of firefighting is the immediate attempt to extinguish a discovered fire. Portable extinguishers are installed throughout the ship to facilitate this effort. The location of the various types of extinguishers take into account the most likely class of fire that will occur considering the fuel loading. The following information is provided to assist in the selection of an appropriate extinguisher.

a) Carbon Dioxide (CO_2)

CO_2 is primarily used to extinguish small class C fires. They have limited effectiveness on small class A and class B fires of low heat intensity and an involved surface area of four square feet or less. A successful attack requires a close approach due to an effective range of four to six feet. Caution is required when using CO_2, especially when more than one extinguisher is used, as CO_2 displaces oxygen.

b) Purple-K-Powder (PKP)

Purple K gets its name from the purple color of the potassium (chemical symbol "K") bicarbonate chemical stored in the extinguisher. The agent is expelled under pressure from a CO_2 or nitrogen cartridge installed in the extinguisher. PKP is very effective on small, isolated class B pool fires (fires less than 10 square feet). PKP can be effective against spray fires; however the standard policy is to abandon the space, secure the source of the pressurized fuel, and utilize fixed suppression systems to combat a flammable liquid spray fire. The maximum range for a portable PKP extinguisher is 20 feet. PKP is intended for use by the unprotected operator who is in the best position to take initial action to extinguish a fire at its onset. Successful use of PKP is time critical.

6. Sprinkler Systems

Dry type sprinkler systems are installed in the magazines and the cargo hold. The systems usually consist of open orifice spray heads fitted to a hard pipe water distribution system. The spray heads are mounted in the upright position using 360 degree dispersion deflectors and sidewall type to provide complete coverage. Drain valves fitted at the lowest points of the water supply and sprinkling piping allow the system to be drained after activation. Compressed air connections are fitted downstream of the sprinkler control valves to test spray heads and to blow dry the piping free of water, scale, and foreign matter. Water supply is from the firemain system. The firemain riser cutout valve are normally open. Each protected space is served by a control valve operable by a reach rod from the damage control deck.

The primary purpose of magazine sprinkler systems is to prevent a dangerous rise of temperature within the magazine due to a fire in adjacent compartments, and secondarily, to extinguish incipient fires within the magazine involving high flash point flammable liquids or ordinary combustibles. The system is not designed nor tested to control or extinguish burning explosives or propellants. These materials typically have their own oxidizers and burn at extremely high temperatures ; in some cases underwater.

B. Personnel Protection

1. Emergency Escape Breathing Device (EEBD)

The EEBD is designed to provide breathing air and eye protection during emergency escape from areas containing toxic gases and smoke. Each EEBD has a flame retardant hood and plastic face shield. It generates 15 minutes of breathable air by means of a low pressure chemical oxygen generator. The EEBD is designed for emergency escape only and shall not be used as a piece of offensive firefighting equipment. Naval Ships' Technical Manual, chapters 077 and 079 vol. 2 provide operation and maintenance instructions.

2. Oxygen Breathing Apparatus (OBA)

The only breathing apparatus authorized for use on board cutters and boats is the Navy Type A-4 OBA. The green, self-starting, single candle type canister is the only authorized canister for use with the Type A-4 OBA. Red canisters are to be used for

training only and shall not be stored in repair lockers. Immediately after a wearer activates a canister, the timer shall be turned to 60 minutes and then turned back to 30 minutes.

If a person wearing an OBA is working alone in a smoke-filled or oxygen-deficient compartment, an insulated tending line shall be used with a tender. The tender shall wear 7500-volt rubber gloves, inside leather gloves, and rubber boots. The tender shall ground the end of the line to bare metal ships structure and be observant of signals from the OBA wearer. It is not recommended for an OBA wearer to enter a machinery space alone with a tending line due to the number of interferences. Two OBA wearers should enter the area together. If a second OBA wearer is not available, then a tending line must be used when a machinery space is entered.

3. Clothing

A fire can reach temperatures exceeding 2000 degrees Fahrenheit and produce dangerous concentrations of smoke and toxic gases. Cutters less than 133' and the 160' WLIC class have an allowance of two firefighters ensembles (FFE); larger cutters have an allowance of four FFEs. The optimum time to don a FFE is approximately 2 minutes, with another 1 to 2 minutes to don and activate an OBA. Under ideal conditions, it takes 2.5 to 5 minutes to don full personnel protection clothing. The scene leader should consider the time it takes to dress out in FFEs allows the fire to grow. In certain situations, rapid response with less protected personnel may result in quick knockdown of a fire. The scene leader makes the decision to request the FFE taking into account the tenability of the area, stage of the fire, and success of the initial attack.

The FFE consists of firefighter's coveralls, firefighter's antiflash hood, damage control/firefighter's helmet, firefighter's gloves, and fireman's boots. Repair party personnel not required to wear the FFE shall wear fire retardant long sleeved uniforms/coveralls, hard shell battle helmet, antiflash hood and gloves. The FFE helmet shall not be altered in any way.

Firefighting activities physically and mentally stress a firefighter. In particular, firefighters outfitted with firefighter ensembles are susceptible to heat stress. A rule of thumb is that personnel fully outfitted in a firefighting ensemble and OBA engaged in firefighting should be relieved after thirty minutes.

The aluminized firefighting suits are only used aboard flight deck equipped cutters. Description and maintenance instructions are provided in Naval Ships' Technical Manual, Chapter 077, and the Shipboard Helicopter Operational Procedures Manual, COMDTINST M3710.2.

4. Naval Firefighting Thermal Imager (NFTI)

The NFTI is a device that permits the user to see through dense smoke and light steam. It can be used to:

- Investigate reported fires
- locate the seat of a fire

- locate and facilitate rescue of injured personnel
- Set and maintain fire boundaries
- locate ignition sources during fire overhaul

The scene leader shall decide when to deploy the NFTI. The NFTI cannot "see" through glass, therefore it is not useful to determine the effectiveness of a Halon 1301 release by "looking" through a viewing port.

Naval Ships' Technical Manual, chapter 555, provides detailed operating instructions and information concerning the tactics for using the NFTI.

5. Firefinder

The Firefinder is a small, handheld, infrared heat sensor which produces an audible alarm when sensing a fire or heat source above 250 degrees F. It can be used to identify hot spots and more effectively maintain firefighting boundaries. Firefinders are sometimes found on small cutters which are not authorized an allowance for a NFTI.

VII. Post-Extinguishment Activities

Overhaul of a fire is an examination and cleanup operation. In addition, ship systems are restored to permit a ship to continue its mission if possible.

A. Desmoking

Small cutters are not equipped with portable desmoking equipment, therefore these cutters should use installed ventilation systems, natural means, or borrowed equipment for desmoking operations. The following sections describe desmoking equipment commonly found on board larger cutters.

1. Red-Devil Blower

The rated capacity of the red devil blower is 500 cfm with 200 ft of 8 inch hose attached. This blower is driven by an explosion proof motor. This blower should not be used to handle air containing explosive vapors. The ram fan discussed in the next section is appropriate for this type of problem.

2. Ram-Fan

The ram fan uses the water pressure for firefighting to drive a turbine for exhausting air. Because it is water driven it can be used below decks in confined areas and is suitable for exhausting explosive vapors.

B. Compartment Testing

The post-fire atmosphere in a compartment shall be tested in sequence for oxygen, combustible gases and toxic gases. Ventilating and retesting is required if initial test results are unsatisfactory.

C. Dewatering

Free water can dramatically impair the stability of a vessel. Every effort should be made to limit the amount of water used; for example preference should be given to the use of water fog over solid streams. Only as much water as is absolutely necessary should be used. Dewatering operations should commence as soon as possible if water is used as an extinguishing agent.

In extreme conditions, flooding and fire may occur simultaneously. The Damage Control Assistant or Commanding officer must make a judgment on the appropriate action and the priority of actions. For example, dewatering and hull repair in conjunction with a flooding emergency may require immediate attention to maintain ship stability. In this case, concurrent actions to passively contain the fire by securing boundaries should be performed as the primary efforts to address the flooding casualty are made.

D. Restoration of Ship's Systems

Electrical power should be restored as soon as possible so that installed ventilation equipment can be operated for desmoking and so that the electric fire pumps are potentially ready for use. Preference in restoring ship systems should be given to electrical power first, then main propulsion, then support systems for crew comfort such as air conditioning and other "hotel" services.

E. Examination and Investigation

The objectives of post-fire examination and investigation are to find and extinguish hidden fire and hot embers. This is an important aspect of firefighting and should be conducted as seriously as extinguishment of the fire itself. Overhaul personnel should investigate ventilation ducts and determine the extent the fire has traveled. Spaces behind paneling and false overheads should be carefully inspected. Wiring and piping penetrations in bulkheads and decks should be carefully inspected because fire can penetrate through extremely small spaces. Signs of structural weakness (especially in aluminum structures) should be reported and strengthened if necessary by shoring and other means. Finally a thorough investigation of the cause of the fire should be conducted and lessons learned documented so that similar fires can be prevented.

Fire Protection Doctrine - Part B

Policies for Firefighting on Large Cutters

Table of Contents

I. Introduction

The approach to firefighting is quite different depending on the classification of the cutter as large or small. "Large" Coast Guard Cutters spend extended periods of time underway, routinely operate off-shore where assistance in the first hour of a fire may not be available, and generally carry hazardous substances such as munitions, paint and flammable substances to facilitate self-sustaining operations. Moreover, the crew size is adequate to man multiple repair parties and the cutters' missions often include military readiness which increases the risk of fire damage from enemy action. All of these considerations distinguish these cutters from "small" cutters which generally make day trips and put into port at night. Their area of operations is close to shore where assistance is readily available and/or abandoning ship is quite feasible. Small cutters do not generally carry paint and other extremely flammable substances on board, this type of material is usually stored ashore in the cutters homeport. Small cutter crew size is minimal and often does not permit manning multiple repair parties. Finally, these cutters do not generally have a military readiness mission, therefore the fire threat from enemy action is virtually non-existent.

In the Coast Guard all vessels with a permanently assigned crew are considered cutters. The smallest cutter is a 65' WYTL Harbor Tugboat and the largest is a 399' WAGB Polar Icebreaker. Presently, <u>for the purposes of fire protection doctrine</u>, large cutters are classified as 180' WLB Seagoing Buoy Tenders and above; small cutters are 157' WLM Coastal Buoy Tenders and below. The purpose of Part B of the fire protection doctrine is to define the philosophical approach and policy applicable to firefighting on "small" cutters. This approach and philosophy is guidance provided by the Commandant and is mandatory for Coast Guard Cutters. The Commandant will issue revisions to this guidance periodically. Part A of the fire protection doctrine provides information pertinent to fire science. Part C of the fire protection doctrine provides firefighting procedures and tactics specific to a class of cutter. The Commanding Officer is required to tailor Part C of the doctrine (within the guidelines provided in Parts A and B) to suit the particular needs of the individual cutter.

II. Firefighting Philosophy and Approach

In very general terms, the firefighting approach on a small cutter employs the following sequence:

- sound the alarm
- apply first aid on fires that are small enough to extinguish quickly with a portable extinguisher
- activate installed fixed fire extinguishing systems
- manually combat the fire until the Commanding Officer/OinC decides that abandoning ship is required

On fires declared "out of control" in the engineering spaces, the general approach is to activate the installed total flooding system and abandon ship if this attack is unsuccessful and the fire spreads beyond the engine room. On larger fires in other spaces

the crew should attempt to fight the fire with the installed firemain system/water, AFFF, or CO_2 depending on the class of fire. This approach is in contrast to that generally used on a large cutter where multiple repair parties dress out in firefighting ensembles and attack the fire using water, AFFF, or CO_2 depending on the class of fire. First aid is attempted with a portable extinguisher if the size of the fire is small enough but abandoning ship is usually not feasible. The following sections provides guidance on the philosophy and approach that should be employed on small cutters in the various stages of firefighting from prevention through post-extinguishment activities.

A. Prevention

The Commanding Officer/Officer-in-Charge and the Engineering Petty Officer shall make frequent inspections of the cutter for the presence of fire hazards, unauthorized stowage of flammable materials, and proper operation/installation of fire and smoke detectors. In general, paint and other flammable materials are not permitted on board small Coast Guard Cutters unless there is suitable compartmentation to safely stow this type of material. For example, paint shall only be stowed in designated Paint Lockers that are protected with an installed CO_2 or Halon 1301 flooding system. Ammunition and ordnance shall only be stowed in magazines protected with a water flooding system. Flammable liquids shall only be stowed on board in designated storage tanks; drums of lube oil, hydraulic oil etc. shall be stowed ashore.

The inspections conducted by the Commanding Officer/OinC and the EPO shall also determine that the installed fire protection systems and detectors are installed properly and ready for instant use. Battery powered smoke detectors shall be tested frequently to ensure the batteries have not been removed or discharged. Discrepancies discovered during these inspections shall be given the highest priority.

B. Detection

The watchstanders shall make rounds at least hourly underway and once every four hours in port (except at night) of every space that has significant fuel loading to detect the presence of fire and smoke.

Where fixed fire alarm systems are not provided, the installation of self-contained, battery operated, smoke detectors shall be required for the protection or personnel in sick bays and berthing areas in accordance with the guidelines contained in the Naval Engineering Manual (COMDTINST M9000.6 (Series) chapter 985).

If a fire is reported, the general quarters alarm shall be sounded and the location and class of fire shall be announced over the general announcing system (1MC).

A P-250 shall be rigged and energized as a backup source of firefighting water. The crew shall muster at their general quarters station.

C. Containment

Historically, the majority of high dollar value fire losses have occurred as a result of class B fires in the main machinery space. Moreover, fires can easily spread from one compartment to the next through open doors and hatches. Therefore, all doors and

hatches to main machinery spaces shall be normally closed in port and underway in accordance with the material condition of readiness in effect. In addition, the crew should be constantly vigilant to control the quantity, type, and distribution of fuel loads to maximize the benefits from passive fire protection features that serve to inhibit fire growth.

The Commanding Officer/OinC shall maneuver the cutter underway to minimize the relative wind which could "fan" the fire. An important exception to this rule is for engine room fires. All fires in the engine room include the possibility of a flammable liquid spray fire, therefore the main engines shall normally be secured for all fires reported in the engine room. The Commanding Officer/OinC may delay securing the main engines due to a navigation hazard. The generators shall be secured in the event of a fire in the engine room unless required to run the MDEs; a P-250 portable pump shall be immediately rigged and energized to provide a source of firefighting water pressure.

For major fires, especially where extreme heat denies access to the fire compartment, boundary cooling of surrounding bulkheads and decks is essential to prevent horizontal and vertical fire spread. Use intermittent bursts of water from a partially open vari nozzle.

The fire shall be isolated by setting material condition ZEBRA, securing ventilation and installing all available inlet and exhaust ventilation covers. Electrical power shall be secured in the compartment where the fire was reported; however lighting shall be secured at the scene leader's discretion.

D. Extinguishment

Standard damage control communications shall be used in firefighting operations. The priority of communications shall be in accordance with the following list: Note, not all cutters have all of these systems but the order of precedence still applies. This list takes into account the fact that on most small cutters the human voice can be heard throughout the cutter.

- Primary - Voice
- Handheld Radio
- Sound Powered Phone
- Salt and Pepper Line
- Damage Control Messages - Runners

The use of damage control wire-free communications (DC WIFCOM) is authorized to supplement, not replace, standard interior communications hard wired circuits (i.e. sound powered phones) for repair party personnel. Where DC WIFCOM is available it may be used as the primary means of communications within the repair locker organization (scene leaders and investigators). DC WIFCOM users must continue to train in message writing to maintain their skills.

The crew shall attempt to extinguish fires until the Commanding Officer/OinC determines that it is necessary to abandon ship. In general there are two basic approaches

to extinguish fires - passive and active. The passive approach is preferred and includes completely isolating the fire and letting the fire extinguish itself. This is feasible if the compartmentation permits closing doors and hatches, the ventilation and electrical power can be completely secured, and pressurized sources of fuel can be secured. The active approach includes discharging a firefighting agent on the fire. This can be accomplished with an indirect attack by activating an installed fixed total flooding system or direct attack by a manual application of the agent. In either event it is critical that the agent used is appropriate for the class of fire. The crew should prepare to aggressively attack the fire if the passive approach is unsuccessful. In port, the majority of the crew may be ashore, but there are usually other ships in port, and professional firefighters may be nearby. The basic approach for small cutters in port is to summon additional help. The following sections provide specific guidance for firefighting underway and in port.

1. Underway

The person discovering a fire underway should ensure that the alarm is passed to the Bridge before attempting to extinguish the fire. The class of fire (class A, B or C) and its location shall be immediately passed to the Bridge so that the crew can take appropriate action. The location shall include the compartment's noun name and identification ("Engine Room, Compartment 3-46-0-E" for example).

The next step involves application of "first aid" with a portable extinguisher on fires small enough to attempt extinguishment safely. On larger fires the person discovering the fire should close all doors, hatches, windows and other accesses to the compartment to isolate the fire. CO_2 and PKP portable extinguishers are strategically located on small cutters. Either agent is more or less effective against all classes of fire but Table B-1 specifies the preferred agent for each class of fire. Do not attempt to extinguish a flammable liquid spray fire until the source of the pressurized fuel is secured.

TABLE B-1 FIRST AID FIREFIGHTING AGENTS

CLASS	PREFERRED AGENT
A	PKP
B	PKP
C	CO_2

In the event of a class B fire in the machinery spaces that cannot be extinguished immediately with PKP, the fire shall be declared "out of control", the space shall be evacuated and the installed total flooding system shall be activated. The on scene leader shall ascertain the effectiveness of the firefighting agent and recommend discharging a second "shot" of firefighting agent if available. The following actions can be used to make this determination:

- monitoring the fire through a viewing port in the door
- monitoring temperatures in the space
- observing smoke discharging from vents

- observing paint blistering and discoloring on bulkheads

In either event, 15 minutes shall elapse before attempting re-entry to permit cooling of hot surfaces below the ignition point. Re-entry shall only be attempted by personnel properly dressed in a FFE and prepared to apply AFFF as the primary firefighting agent.

A flammable liquid spray fire shall be automatically considered a class B fire out of control. Past experience and fire testing have shown that a pressurized release of a flammable liquid can create a fire that is unapproachable. Life threatening conditions created by extreme heat, smoke and toxic gases can occur in as little as 60 seconds. Under such conditions the only prudent course of action is to evacuate the space, secure the fuel source and activate the installed total flooding system.

An oil leak in the engine room shall be repaired immediately, a major oil leak shall be automatically considered equivalent to a class B fire. That is, it shall be reported immediately to the bridge, engines shall be secured and preparations to fight a class B fire with AFFF shall be accomplished.

The decision to secure lighting in affected spaces shall be made by the on scene leader. Every effort shall be made to mechanically and electrically (other than lighting) isolate the affected spaces. The decision to commence firefighting efforts may be made by the on scene leader before electrical isolation is complete.

Re-entry into a machinery space that has been evacuated because a fire was declared out of control is the most critical and hazardous part of the firefighting evolution. The decision to reenter the space should be made only if there is reasonable evidence that the fire is out. Re-entry personnel shall be dressed out in firefighter's ensembles (FFE) including one piece coverall, gloves, anti-flash hood, helmet, and steel toed rubber boots. Re-entry teams shall use 1 1/2" hoses and AFFF as the primary firefighting agent. AFFF for the lead hose may be supplied from 5 gallon cans using an in line proportioner designed for use with 95 gpm vari nozzles. The primary functions of the re-entry team is to rescue trapped personnel, to ensure the fuel source is secured, to overhaul the fire, and to lay a blanket of foam on any flammable liquids to prevent a reflash.

2. In Port

The local fire department (military or civilian) should be familiar with the cutter. Periodic visits should be conducted to acquaint new members of the fire department with the cutter and its fire protection doctrine. A copy of the cutter's fire protection doctrine shall be made available to the fire department and kept up to date by the cutter.

The Coast Guard uses two types of threads in its firemain system: National Standard Hose Threads for 2.5" and larger connections, and National Pipe Straight Hose Threads for 1.5" connections. These threads may not be compatible with municipal fire departments. On cutters which do not have 2.5" topside hose connections, it is necessary to install a 2.5" male by 1.5" female adapter to the International Shore Connection (Ship). All cutters shall ensure that local fire departments have the companion flange to the International Shore Connection (Ship).

Watchstanders are often alone on the cutter for the major part of a day. Before attempting to fight a fire in port, the local fire department shall be notified and assistance requested.

E. Post-Extinguishment Actions

Combustible gases may be present after a compartment fire has been extinguished. Carbon monoxide will be the predominant gas generated in a class A or class C fire; substantial concentrations are required (12.5% is the lower flammable limit) before carbon monoxide will ignite. Therefore, after a class A or class C fire, desmoking with installed ventilation equipment can proceed with minimal risk. If the fire involved class B materials, the presence of flammable liquids can create a flammable atmosphere. Operating electric controllers to start ventilation fans may ignite these gases. After a class B fire, the presence of combustible gases should be assumed; desmoking with installed ventilation equipment can proceed with minimal risk under the following conditions:

- The class B fire has been extinguished
- AFFF has been used to cover flammable liquids
- The source of fuel has been secured
- The space has been allowed to cool for at least 15 minutes
- All fuel has been washed into the bilge
- No damage has been sustained to the ventilation equipment
- No damage has been sustained by the ships service generator

If desmoking with the installed ventilation system is prudent, all fans (supply and exhaust) should be operated on high speed for at least 15 minutes. Desmoking shall precede atmospheric testing because combustible gas analyzers will not operate reliably in a halon atmosphere and oxygen analyzers will not operate reliably if the sensor is exposed to excessive moisture, heat or particulate found in a post-fire atmosphere. When the space is tested for oxygen and combustible gases, oxygen shall be between 20 - 22 percent, combustible gases shall be less than 10 percent of the lower explosive limit, and all toxic gases below their threshold limit values before the space can be certified safe to enter without OBAs.

Shipboard personnel authorized to conduct post-fire atmospheric tests for the purpose of certifying the space safe for personnel are gas-free engineers and gas-free petty officers (E-5 and above) as defined by the Naval Ships Technical Manual, Chapter 074, Volume 3. When emergency conditions exist and the gas-free engineer or gas free petty officer are not available, a performance qualification standard (PQS) qualified repair party post fire gas free test assistant may perform testing with the approval of the Commanding Officer. The repair party post-fire gas-free test assistant may not perform "safe for hot work" gas free tests unless he is qualified per the requirements of NSTM 074 vol. 3.

The extent of testing for toxic gases is dependent on the effectiveness of desmoking. When the installed ventilation system is operated on high speed for at least 15

minutes, the only toxic gas test required is for carbon monoxide. If desmoking is accomplished by less effective means, tests are required for carbon monoxide, carbon dioxide, hydrogen chloride, hydrogen cyanide, and hydrocarbons. In addition if halon has been discharged a test for hydrogen fluoride must be conducted if the installed ventilation system was not operated on high speed for 15 minutes to desmoke.

A compartment is considered safe only after satisfactory test results have been achieved at all test locations during the latest round of tests.

Fire Protection Doctrine - Part C

Procedures for Firefighting on WLM(R)

Table of Contents

I. Introduction

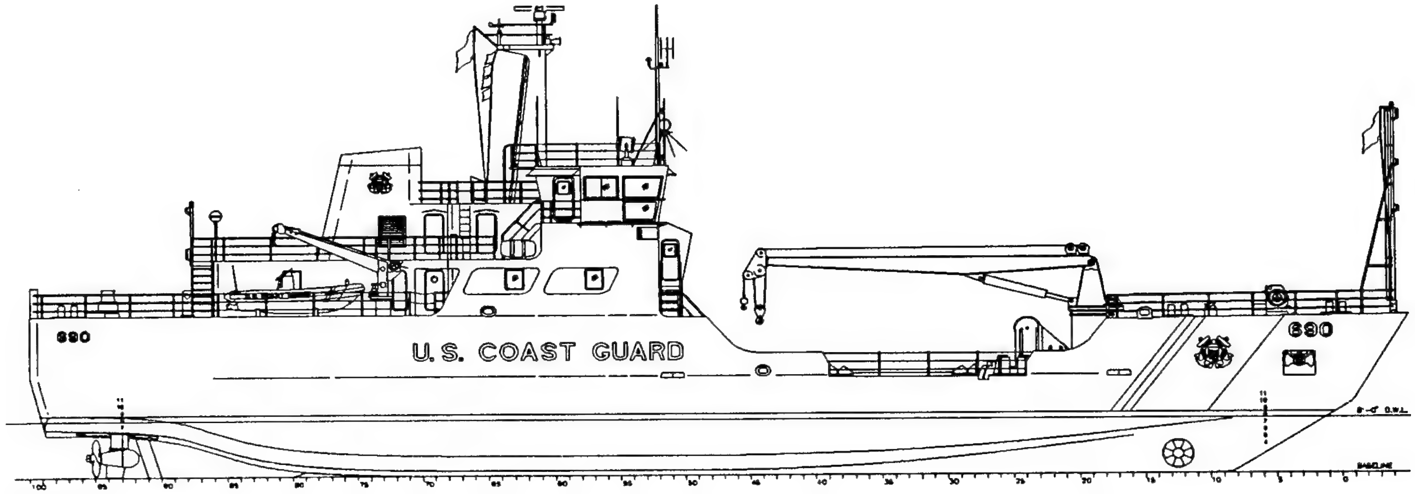
One of the most life threatening and hazardous activities that may be encountered on board ship is fighting a fire. Unlike a building fire, the crew often can not evacuate and leave the firefighting to trained professionals. The crew must extinguish the fire, often without assistance, and using only the available equipment on board. Once a fire occurs, it is too late to read this doctrine, it is too late to obtain training, and it is too late to repair and maintain damage control equipment. Finally, the procedures in this doctrine are not a substitute for the exercise of good judgment based on experience and the particular conditions that exist at the time.

The purpose of this doctrine is to provide useful background information pertinent to fire science (Part A), guidance promulgated by Commandant for "small" classes of Coast Guard Cutters (Part B), and tactical firefighting procedures for each class of fire likely to be encountered on this class of vessel, inport and underway (Part C). Note, the Commanding Officer is responsible for tailoring Part C of this doctrine within the guidelines set forth in the following documents:

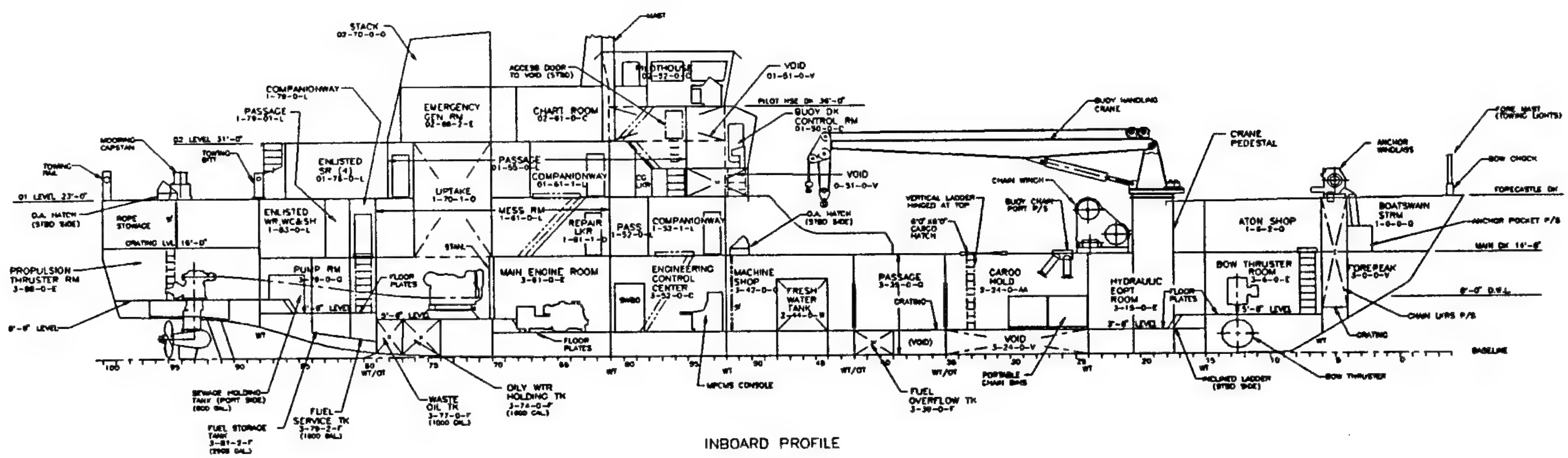
- Naval Ships' Technical Manual (NSTM) Chapter 074, Volume 3
- Naval Ships' Technical Manual (NSTM) Chapter 077
- Naval Ships' Technical Manual (NSTM) Chapter 079
- Naval Ships' Technical Manual (NSTM) Chapter 555
- FXP-4
- Surface Ship Survivability, NWP 62-1
- COMDTINST M9000.6B, Naval Engineering Manual
- The Cutter's Fire Protection Doctrine, Parts A and B
- The Cutter's Engineering Casualty Control Manual

II. Vessel Characteristics

The 175' WLM(R) is a Coastal Buoy Tender; its primary missions are Short Range Aids to Navigation, Marine Environmental Response, and Search and Rescue. The ship is constructed entirely of steel. The inboard and outboard profile views and plan views of each deck of the WLM (R) are shown in Figures C.1 through C.3. A description of significant fuel loads, installed firefighting systems and access/egress routes for each compartment in the cutter are also provided in this section of the doctrine.



OUTBOARD PROFILE



INBOARD PROFILE

Figure C.1 WLM(R) Inboard and Outboard Profile

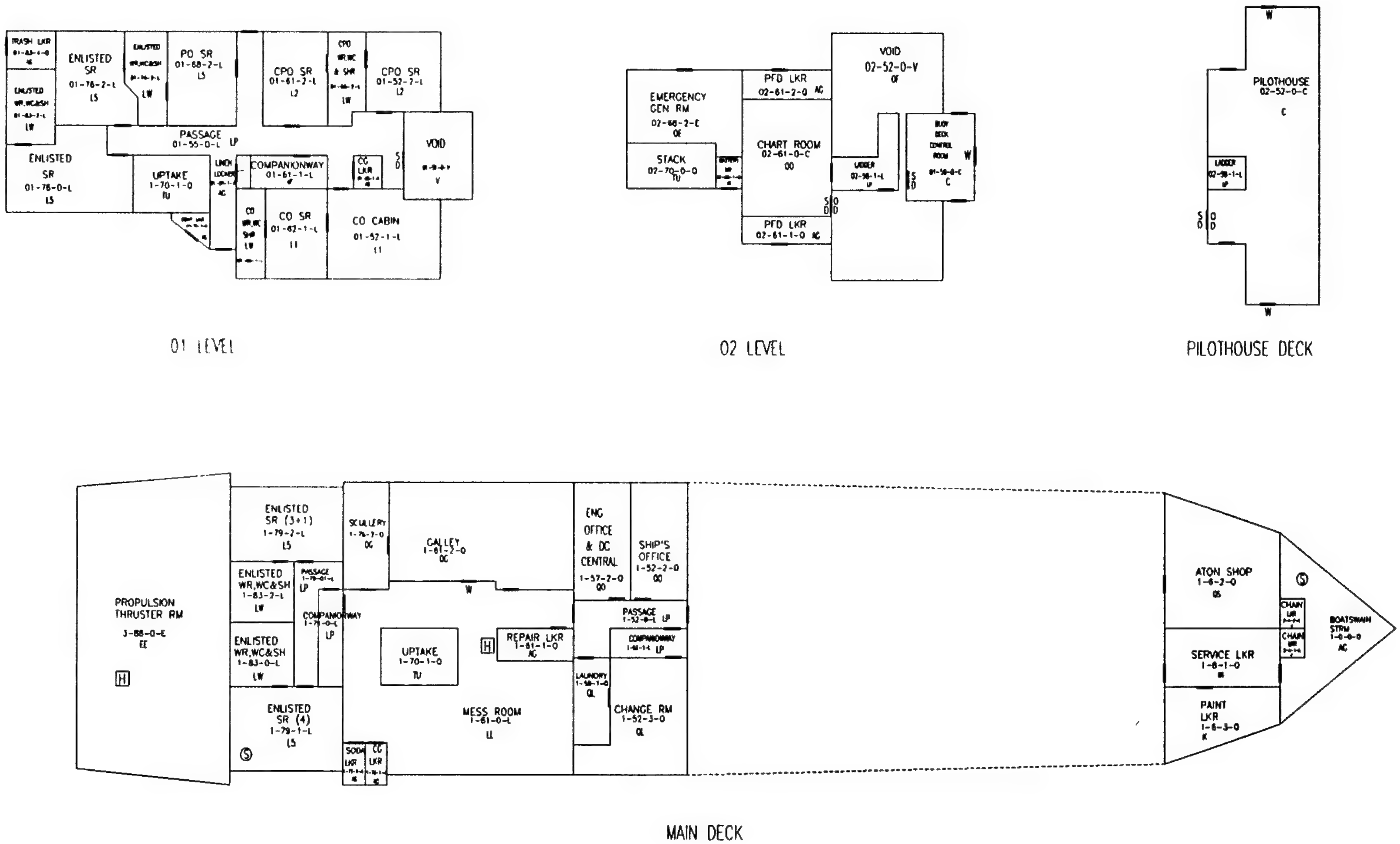


Figure C.2 WLM(R) Main Deck, 01 Level, 02 Level, and Pilothouse Deck

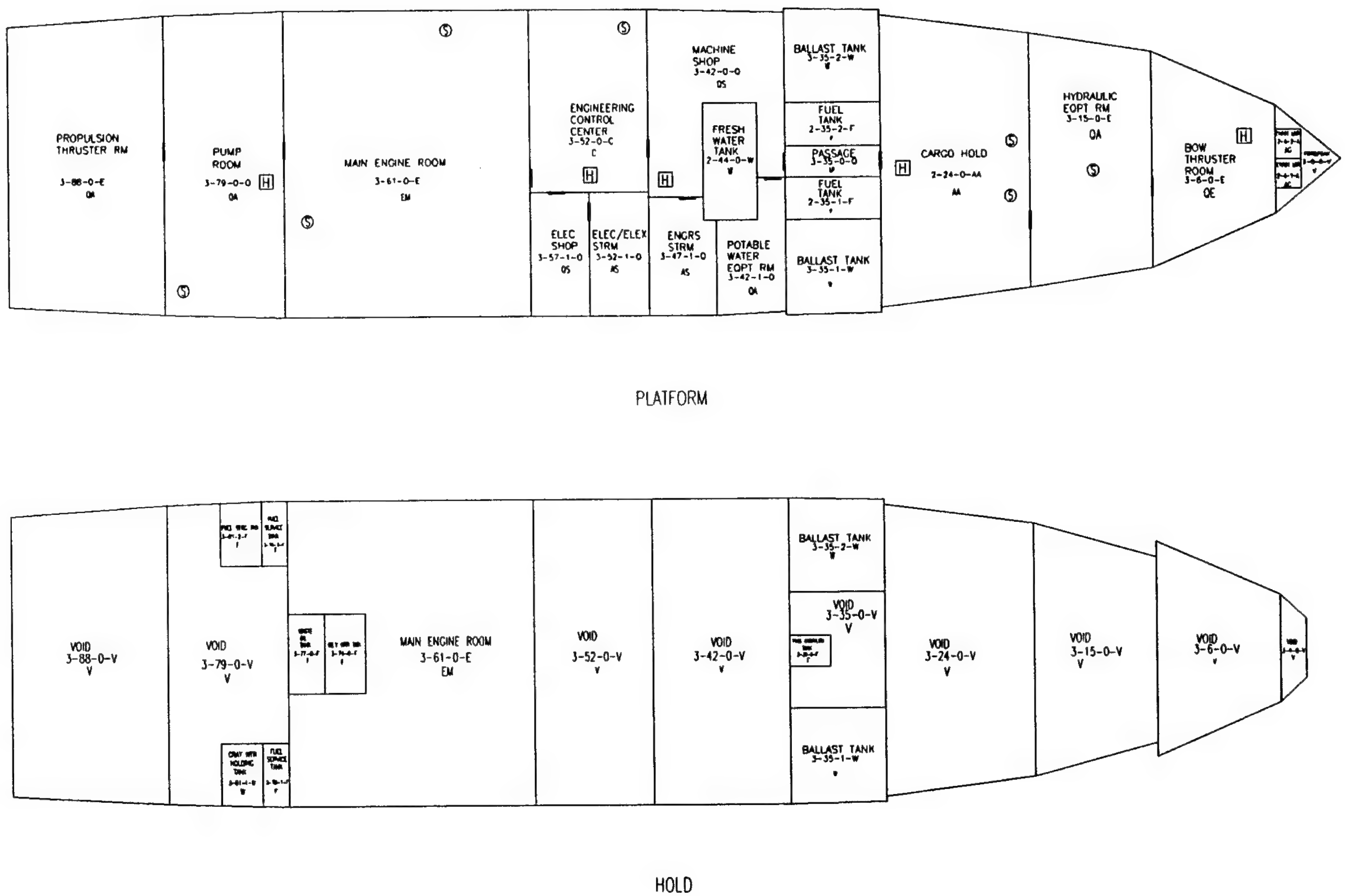


Figure C.3 WLM(R) Main Deck and Hold Deck

A. Compartmentation

1. Below the Main Deck

Below the main deck, the cutter is divided into the following ten areas, each separated by a steel watertight bulkhead:

(a) Forepeak and Chain Lockers

The Forepeak Tank and Chain Lockers are located in the bow below the Boatswain's Storeroom; they are inaccessible and contain no combustible materials.

(b) Bow Thruster Room

The Bow Thruster Room contains a controller and electric motor for the bow thruster located in a tunnel running athwartships. The Bow Thruster Room is protected by an installed 6% AFFF overhead sprinkling system.

A watertight door in the aft bulkhead on the starboard side permits egress to the Hydraulic Equipment Room. A scuttle in a 30" x 60" watertight hatch in the overhead forward on the port side, accessible via an inclined ladder, also permits egress to the ATON Shop above.

(c) Hydraulic Equipment Room

The pedestal for the buoy handling crane and the hydraulic power unit for the deck machinery such as the cross deck winches and chain winch are located in the Hydraulic Equipment Room.

Two means of normal egress are provided:

- Forward to the Bow Thruster Room via a short inclined ladder and a watertight door on the starboard side and,
- aft to the Cargo Hold via a watertight door on the starboard side.

Emergency egress is permitted via a vertical ladder through a 21" escape scuttle to the Buoy Deck.

(d) Cargo Hold

The Cargo Hold is a large compartment below the Buoy Deck designed for temporary stowage of buoys and sinkers as well as buoy chain in portable chain bins accessible from chain ports in the Buoy Deck. Hose reels are mounted on the overhead aft on the port and starboard sides.

Two means of normal egress are provided:

- forward to the Hydraulic Equipment Room through a watertight door on the starboard side and,
- aft to the Machine Shop via a passage and two watertight doors on the centerline.

When the 6' x 6' cargo hatch is open for stowing or removing buoys and sinkers, access is permitted via a hinged vertical ladder.

(e) Ballast Tanks, Fuel Tanks, and Passageway

A centerline passageway connects the Machine Shop aft with the Cargo Hold forward through watertight doors. Two inaccessible fuel tanks and two inaccessible ballast tanks are located outboard of the Passageway.

(f) Machine Shop, Engineers Storeroom, Fresh Water Tank, and Potable Water Equipment Room

The Machine Shop on the port side contains fixed equipment such as a hydraulic press, drill press, workbench, and grinder. The Engineers Storeroom on the starboard side aft is segregated from the Machine Shop by an expanded metal bulkhead and contains spare parts on shelves and in bins. The Potable Water Equipment Room on the starboard side forward is segregated from the Machine Shop and Engineer's Storeroom by watertight bulkheads and a watertight door on the centerline and contains fresh water transfer pumps and their associated controllers. A 5000 gallon potable water tank is located on the centerline within the boundaries of the Machine Shop.

Two means of normal egress are provided:

- forward to the Cargo Hold via a centerline passageway and two watertight doors and,
- aft to the Engineering Control Center through a watertight door on the centerline.

Emergency egress is permitted via a vertical ladder to a 30" x 30" quick acting escape hatch to the Buoy Deck. This hatch is located in the Machine Shop aft on the starboard side near the Engineer's Storeroom.

(g) Engineering Control Center, Electric Shop, and Electrical/Electronics Storeroom

The Engineering Control Center on the port side contains the ship service switchboard and MPCMS console. The Electric Shop aft on the starboard side is segregated by a watertight bulkhead from the Engineering Control Center and by an expanded metal bulkhead from the Electrical/Electronics Storeroom forward on the starboard side. The Electric Shop is accessible from the Engineering Control Center through a watertight door and contains an electrical test bench and other electrical test equipment. The Electrical/Electronics Storeroom is accessible only from the Electric Shop through an expanded metal door; this space contains spare parts such as light bulbs, switches, printed circuit boards and other electrical/electronic spare parts on shelves and in bins.

Three means of normal egress are provided:

- forward to the Machine Shop through a watertight door (the vertical ladder to the emergency escape hatch in the Machine Shop is located close to this door),
- aft to the Main Engine Room through a watertight door on the centerline and,
- up an inclined ladder through a passing scuttle in a 30" x 60" watertight hatch to the Companionway starboard of the longitudinal Passageway on the Main Deck (this Passageway leads to the Buoy Deck forward and the Mess Deck aft).

Emergency egress is permitted via a vertical ladder on the port side through a 21" escape scuttle to the Ship's Office.

(h) Main Engine Room

The Main Engine Room contains two main diesel engines for propulsion and three ship service generator sets with diesel engine prime movers. All five diesel engines exhaust through the Uptake vertically to the Stack above. The Engine Room also contains the #1 electric fire pump. The Engine Room is protected by an installed CO_2 total flooding system. In addition the bilge areas are protected by an installed 6% AFFF bilge sprinkling system. The following oil tanks are located in or below this space:

- 200 gallon lube oil tank in the space on the starboard side,
- 1000 gallon waste oil tank below the space on the centerline aft and,
- 1600 gallon oily water holding tank below the space on the centerline aft.

Two means of normal egress are provided:

- forward to the Engineering Control Center through a watertight door on the centerline and,
- aft to the Pump Room through a watertight door on the centerline.

Two means of emergency egress are provided:

- forward on the port side up a vertical ladder through a 21" escape scuttle to the Galley and,
- aft on the starboard side up a vertical ladder through a 21" escape scuttle to the Mess Deck.

(i) Pump Room, Fuel Tanks, and Gray Water Holding Tank

The Pump Room contains the sewage treatment equipment and the fuel oil transfer pumps and manifolds; in addition it contains the #2 electric fire pump. This fire pump shares a common sea chest with the #1 fire pump in the Engine Room. The Pump Room is protected by an installed 6% AFFF overhead sprinkling system. The following tanks are located in or below this space:

- 800 gallon sewage holding tank in the space aft on the port side,
- 1800 gallon gray water holding tank below the space forward on the starboard side,
- three fuel tanks of different capacities below the space forward on the port and starboard sides.

Three means of normal egress are provided:

- forward to the Main Engine Room through a watertight door on the centerline,
- aft to the Propulsion Thruster Room up a short inclined ladder through a watertight door on the centerline and,

- up an inclined ladder through a passing scuttle in a 30" x 60" watertight hatch to the Companionway aft of the Mess Deck and forward of the transverse Passageway on the Main Deck.

(j) Propulsion Thruster Room

This compartment spans two levels (Main Deck and Second Deck) and contains the port and starboard propulsion thruster units. The space is protected by an installed 6% AFFF overhead sprinkling system. Normal egress is through the watertight door on the centerline forward to the Pump Room. Emergency egress is provided via a vertical ladder to a 30" x 30" quick acting hatch on the 01 Deck aft.

2. The Main Deck

The P-250 Mod 1 pump is stowed forward on the port side of the Buoy Deck. The portable gasoline cans for this pump are stowed on the 01 Deck aft on the starboard side. Oxygen storage bottles and acetylene storage bottles for the oxy-acetylene hose reel are located port and starboard forward of the buoy deck; the hose reel is located on the centerline. Compartments on the Main Deck forward of the Buoy Deck, are divided into two areas, each separated by a steel watertight bulkhead. Aft of the Buoy Deck, compartments on the Main Deck are divided into four areas, each separated by a steel watertight bulkhead:

(a) Boatswain's Storeroom

This compartment contains extra gear for the deck force such as canvas covers, tools and equipment for preserving the hull, etc. stowed on shelves. Normal egress is provided through a watertight door on the starboard side to the Service Locker aft. Emergency egress is permitted through a 18" passing scuttle to the 01 Deck which is designed to pass mooring lines (an installed vertical ladder to this scuttle does not exist).

(b) ATON Shop, Service Locker, and Paint Locker

The ATON Shop contains a workbench to service buoy flashers, etc. Stowage for spare flashers on shelves and in cabinets and a battery charging station for charging buoy batteries. Two means of normal egress are provided:

- aft through a watertight door on the port side to the Buoy Deck aft and,
- forward through a scuttle in a 30" x 60" hatch in the Main Deck and down an inclined ladder into the Bow Thruster Room. Egress can then be effected aft through the Hydraulic Equipment Room and Cargo Hold.

The Service Locker contains a welding machine and other equipment designed to service buoys. Two means of normal egress are provided:

- Forward through a watertight door to the Boatswains Storeroom and,
- Aft through a watertight door to the Buoy Deck.

The Paint Locker contains open and closed cans of paint and other flammable liquids. This space is accessible through a watertight door from the Service Locker and is protected by an installed CO_2 total flooding system.

(c) Ship's Office, Engineering Log Office & DC Central, Passageway, Change Room, and Laundry

The Ship's Office contains typical office equipment such as copy machines, computers, printers, microfiche reader, typewriters, etc. In addition, there is a considerable quantity of files and paper records stowed in filing cabinets. Normal access is provided through a joiner door from the longitudinal Passageway on the Main Deck. Emergency egress is provided through a 21" scuttle in the Main Deck and a vertical ladder to the Engineering Control Center below.

The Engineering Log Office & DC Central contains engineering paper records stowed in filing cabinets, microfiche reader, computers, printer, and technical publications on open book shelves. Normal access is provided through a joiner door from the longitudinal Passageway on the Main Deck.

The Laundry contains washers and dryers and various quantities of crews clothing. Normal access is provided through a joiner door from the longitudinal Passageway. Egress to the Companionway starboard of the longitudinal Passageway is also permitted through the Change Room and two joiner doors. The Change Room contains crews clothing on hooks and on shelves

(d) Dry Stores, Galley, Scullery, Repair Locker, Mess Deck, and Uptake

The Galley and Dry Stores are on the port side and are accessible through a joiner door as well as the 10' passing window from the Mess Deck. These compartments contain various foodstuffs on shelves and in cabinets as well as cooking utensils and appliances. The galley stove is protected with an installed aqueous potassium carbonate fire extinguishing system for grease fires. Emergency egress is provided through a 21" scuttle and a vertical ladder to the Main Engine Room below. The Scullery is accessible from the Galley through a joiner door and a 24" passing window from the Mess Deck. The Scullery contains the dishwasher and plastic/glass dishes.

The Mess Deck contains vending machines, beverage serving containers, tables and upholstered seats as well as televisions and other electronic recreational equipment for the crew. The Repair Locker contains various damage control equipment and is accessible from the Mess Deck through a joiner door. Three means of normal egress are provided from the Mess Deck:

- Forward through a watertight door to the longitudinal Passageway on the Main Deck,
- Aft through a watertight door to the Companionway which accommodates the ladder down to the Pump Room and,
- Up an inclined ladder to the 01 Deck Companionway and through a joiner door to the 01 Deck longitudinal Passageway.

Emergency egress is provided through a 21" scuttle and a vertical ladder to the Engine Room below.

(e) Enlisted Staterooms, Heads, and Passageway

A transverse Passageway accessible from the Companionway provides normal access to the Enlisted Staterooms 1-79-1&2-L. These staterooms are designed to accommodate 4 persons each and contain mattresses, pillows and clothes. Emergency egress is provided for 1-79-1-L through a 21" scuttle and vertical ladder up to the Boat Deck above. Emergency egress is not presently permitted from 1-79-2-L, however, the installation of a "kick-out" panel in the common longitudinal bulkhead between the associated sanitary spaces for these staterooms would provide means of emergency egress.

3. Above the Main Deck

(a) 01 Deck

The 01 Deck includes the Buoy Deck Control Room, the Commanding Officer's Quarters, Chief Petty Officer's Quarters, and Senior Enlisted Berthing, Heads, Trash Locker, Uptake, Boat Locker, and Passageway. The rigid hull inflatable (RHI) is stowed on the Boat Deck aft on the starboard side of the 01 Deck. The portable gasoline cans for the RHI are stowed aft on the 01 Deck.

The Buoy Deck Control Room contains the console for controlling the hydraulic buoy handling crane and is accessible from the port and starboard sides aft on the Buoy Deck up short inclined ladders through weathertight doors and aft through a joiner door and down a short inclined ladder to the longitudinal 01 Deck Passageway.

The Commanding Officer's Quarters, Chief Petty Officer's Quarters, and Senior Enlisted Berthing are accessible through joiner doors from the longitudinal 01 Deck Passageway. This Passageway may be accessed from the port and starboard side 01 Deck through weathertight doors. At the forward end of this Passageway access to the Chart Room is provided by an inclined ladder through a joiner door.

The Boat Locker and Trash Locker are accessible from the 01 Deck through weathertight doors.

(b) 02 Deck

The 02 Deck includes the Pilothouse, Chart Room, and Emergency Generator Room, PFD Lockers, Battery Locker and the Stack.

The Emergency Generator Room contains the Emergency Generator and associated diesel engine prime mover as well as the emergency switchboard. A 250 gallon diesel oil service tank is contained within the space. The Emergency Generator Room is accessible from the port side 02 Deck through a weathertight door. The Chart Room contains charts in the chart table drawers and is accessible through a joiner door and an inclined ladder to the 01 Deck longitudinal Passageway below and by a short inclined ladder to the Pilothouse above. The Emergency Generator Room is protected by an installed CO_2 total flooding system.

The PFD Lockers and the Battery Locker are accessible from the 02 Deck through weathertight doors.

The Pilothouse contains various electronic and communications equipment as well as surveillance equipment such as radar. The consoles in the Pilothouse permit interior

communication with the Buoy Deck Control Room, and Engineering Control Center to enable controlling the machinery plant and operations on the Buoy Deck. Access is provided through weathertight doors on the port and starboard side 02 Deck and a short open inclined ladder to the Chart Room aft.

B. Diesel Engine Shutdowns

There are two main diesel engines and three ship service diesel generators and one emergency diesel generator. The following sections provide information for securing these engines in the event of a fire.

1. Main Diesel Engines

The main diesel engines are provided with individual remote emergency shutdowns in the form of a manual pull cable to trip the fuel racks or secure the intake air. The emergency shutdowns are designed to secure the engines within 60 seconds. The pull handles are located in a recessed box outside the entrance to the engine room. The emergency shutdowns can also be activated locally at the engine.

2. Ship Service Generators

The ship service generator diesel engines are provided with individual remote emergency shutdowns in the form of a manual pull cable to trip the fuel racks or secure the intake air. The emergency shutdowns are designed to secure the engines within 60 seconds. The pull handles are located in a recessed box outside the entrance to the engine room. The emergency shutdowns can also be activated locally at the engine.

3. Emergency Generator

The emergency generator diesel engine is provided with a remote emergency shutdown in the form of a manual pull cable to trip the fuel racks or secure the intake air. The emergency shutdown is designed to secure the engine within 60 seconds. The pull handle is located in a recessed box outside the entrance to the Emergency Generator Room. The emergency shutdowns can also be activated locally at the engine.

C. Ventilation

The quantity, size (CFM), type (supply/exhaust/recirculation), and location of ventilation fans is TBD. The location of remote shutdowns for these fans is also TBD.

D. Fire Detection Equipment

The fire and smoke detection system is a “Pyrotronics, System 3”. The location of the master alarm panel and the remote panel is to be determined (TBD). The quantity, type, and location of the detectors installed in the WLM (R) are shown in Table C.1.

Table C.1 Fire Detection Equipment (page 1 of 2)

Plan ID	Compartment Name	Detection Systems
CUI=AA	**(Cargo Holds)**	
2-24-0-AA	CARGO HOLD	2 Ioniz. Smoke
CUI=AG	**(Gear Lockers)**	
2-4-1-A	CHAIN LKR	None
2-4-2-A	CHAIN LKR	None
1-0-0-Q	BOATSWAIN STRM	1 Ioniz Smoke
1-61-1-Q	REPAIR LKR	1 Ioniz Smoke
1-76-1-A	CLEANING GEAR LOCKER	1 Ioniz Smoke
01-53-1-A	CLEANING GEAR LOCKER	1 Ioniz Smoke
01-67-1-A	LINEN LOCKER	1 Ioniz Smoke
01-70-1-Q	BOAT LKR	1 Ioniz Smoke
01-83-4-Q	TRASH LKR	1 Ioniz Smoke
02-61-1-Q	PFD LKR	1 Ioniz Smoke
02-61-2-Q	PFD LKR	1 Ioniz Smoke
02-68-1-Q	BATTERY LKR	1 Ioniz Smoke
CUI=AS	**(Storerooms)**	
3-47-1-Q	ENGRS STRM	1 Ioniz Smoke
3-52-1-Q	ELEC/ELEX STRM	1 Ioniz Smoke
1-77-1-A	SODA LKR	1 Ioniz Smoke
CUI=C	**(Ship Control, Communication)**	
3-52-0-C	ENGINEERING CONTROL CTR	1 Ioniz Smoke
01-50-0-C	BUOY DECK CONTROL ROOM	1 Ioniz Smoke
02-52-0-C	PILOTHOUSE	1 Ioniz Smoke
CUI=EM	**(Main Propulsion-Mechanical)**	
3-6-0-E	BOW THRUSTER ROOM	1 Ioniz Smoke
3-61-0-E	MAIN ENGINE ROOM	3 Ioniz Smoke/ 4 Flame
CUI=K	**(Hazardous Material Storage)**	
1-6-3-Q	PAINT LKR	1 Ioniz Smoke
CUI=L1	**(Senior Officer's Cabin)**	
01-52-1-L	CO CABIN	1 Ioniz Smoke
01-62-1-L	CO SR	1 Ioniz Smoke
CUI=L2	**(Officer/CPO Quarters)**	
01-52-2-L	CPO SR (1)	1 Ioniz Smoke
01-61-2-L	CPO SR (1)	1 Ioniz Smoke
CUI=L5	**(Crews Berthing)**	
1-79-1-L	ENLISTED SR (4)	1 Ioniz Smoke
1-79-2-L	ENLISTED SR (3+1)	1 Ioniz Smoke
01-68-2-L	PO SR (2+2)	1 Ioniz Smoke
01-76-0-L	ENLISTED SR (4)	1 Ioniz Smoke
01-76-2-L	ENLISTED SR (2+2)	1 Ioniz Smoke
CUI=LL	**(Wardroom/ Mess/ Lounge Area)**	
1-61-0-L	MESS ROOM	1 Ioniz Smoke
CUI=LP	**(Passageway/Staircase/Vestibule)**	
3-35-0-Q	PASSAGE	1 Ioniz Smoke
1-52-0-L	PASSAGE	1 Ioniz Smoke
1-52-1-L	COMPANIONWAY	1 Ioniz Smoke
1-79-0-L	COMPANIONWAY	1 Ioniz Smoke
1-79-01-L	PASSAGE	1 Ioniz Smoke
01-55-0-L	PASSAGE	2 Ioniz Smoke
01-61-1-L	COMPANIONWAY	1 Ioniz Smoke
02-58-1-L	LADDER	1 Ioniz Smoke

Table C.1 Fire Detection Equipment (page 2 of 2)

Plan ID	Compartment Name	Detection Systems
CUI=LW	**(Sanitary Spaces)**	
1-83-0-L	ENLISTED WR,WC&SH	1 Ioniz Smoke
1-83-2-L	ENLISTED WR,WC&SH	1 Ioniz Smoke
01-58-2-L	CPO WR,WC	1 Ioniz Smoke
01-66-1-L	CO WR,WC SHR	1 Ioniz Smoke
01-74-2-L	ENLISTED WR,WC&SH	1 Ioniz Smoke
01-83-2-L	ENLISTED WR,WC&SH	1 Ioniz Smoke
CUI=QA	**(Aux Machinery Spaces)**	
3-15-0-E	HYDRAULIC EQPT RM	1 Ioniz Smoke
3-42-1-Q	POTABLE WATER EQPT RM	1 Ioniz Smoke
3-79-0-Q	PUMP ROOM	2 Ioniz Smoke
3-88-0-E	PROPULSION THRUSTER RM	2 Ioniz Smoke
CUI=QE	**(Emergency Aux Generator Rm)**	
02-68-2-E	EMERGENCY GEN RM	1 Ioniz Smoke/ 2 Flame
CUI=QF	**(Fan Room)**	
02-52-0-V	VOID	1 Ioniz Smoke
CUI=QG	**(Galley/ Pantry/ Scullery)**	
1-61-2-Q	GALLEY	1 Ioniz Smoke
1-76-2-Q	SCULLERY	1 Ioniz Smoke
CUI=QL	**(Laundry)**	
1-52-3-Q	CHANGE RM	1 Ioniz Smoke
1-58-1-Q	LAUNDRY	1 Ioniz Smoke
CUI=QO	**(Office Spaces)**	
1-52-2-Q	SHIP'S OFFICE	1 Ioniz Smoke
1-57-2-Q	ENG OFFICE AND DC CENTRAL	1 Ioniz Smoke
02-61-0-C	CHART ROOM	1 Ioniz Smoke
CUI=QS	**(Shops)**	
3-42-0-Q	MACHINE SHOP	1 Ioniz Smoke
3-57-1-Q	ELEC SHOP	1 Ioniz Smoke
1-6-1-Q	SERVICE LKR	1 Ioniz Smoke
1-6-2-Q	ATON SHOP	1 Ioniz Smoke
CUI=TU	**(Stacks/ Engine Uptakes)**	
1-70-1-Q	UPTAKE	1 Ioniz Smoke
02-70-0-Q	STACK	1 Ioniz Smoke
CUI=V	**(Voids/ Cofferdams)**	
3-0-0-V	FOREPEAK	None
3-15-0-V	VOID	None
3-24-0-V	VOID	None
3-35-0-V	VOID	None
3-4-0-V	VOID	None
3-42-0-V	VOID	None
3-52-0-V	VOID	None
3-6-0-V	VOID	None
3-79-0-V	VOID	None
3-88-0-V	VOID	None
01-51-0-V	VOID	None
CUI=W	**(Water Tank)**	
3-35-1-W	BALLAST TANK	None
3-35-2-W	BALLAST TANK	None
3-81-1-W	GRAY WTR HOLDING TNK	None
2-44-0-W	FRESH WATER TANK	None

E. Firefighting Equipment

1. Firemain Stations

There are 18 firemain stations configured for water or AFFF located throughout the cutter as shown in Table C.2:

Table C.2 Firemain Stations

No.	Deck,Frame & Item No.	Location	Type
1	2-90-1	Propulsion Thruster Room (3-88-0-E)	Water
2	2-79-1	Pump Room (3-79-0-Q)	Water
3	01-87-0	01 Weather Deck	Water
4	3-61-2	Engine Room (3-61-0-E)	Water
5	01-70-1	Passageway (01-55-0-L)	Water
6	2-42-2	Machine Shop (3-42-0-Q)	Water
7	01-58-2	Passageway (01-55-0-L)	Water
8	2-24-1	Cargo Hold (2-24-0-AA)	Water
9	01-14-2	Forecastle Weather Deck	Water
10	2-8-1	Bow Thruster Room (3-6-0-E)	Water
11	1-79-2	Companionway (1-79-0-L)	AFFF/Water
12	1-75-2	Passageway (1-52-0-L)	AFFF/Water
13	1-59-2	Passageway (1-52-0-L)	AFFF/Water
14	02-68-2	02 Weather Deck	Water
15	1-51-1	Main Weather Deck	AFFF/Water
16	1-17-2	Main Weather Deck	AFFF/Water
17	1-14-2	ATON Shop (1-6-2-Q)	AFFF/Water
18	02-68-1	02 Weather Deck	Water

These fire stations are pressurized from either of two electric fire pumps located in the Engine Room and Pump Room. These pumps can be started locally or remotely from the Bridge.

2. CO_2 Total Flooding System

The Engine Room, Emergency Generator Room and the Paint Locker are protected by independent installed CO_2 total flooding systems. Each system is activated by operation of CO_2 remote actuation controls located near the entrance to each protected space or activation of the remote release at a different location. Exact locations of remote releases are TBD. Actuation of the system sounds an audible alarm and automatically shuts down internal combustion engines within the space and ventilation fans serving the space. In addition, there is an automatic delay of 60 seconds built into the system to allow personnel to evacuate and for the ventilation fans to coast down.

3. AFFF Sprinkling System

The Engine Room, Pump Room, Propulsion Thruster Room and Bow Thruster Room are protected by an installed AFFF flooding system. This system is capable of flooding any or all of these spaces independently or simultaneously. AFFF concentrate is stored in a tank located in the longitudinal Main Deck Passageway. A balanced pressure proportioner proportions the correct amount of AFFF concentrate into the seawater flowing through the firemain system to ensure the correct 6% mix of AFFF is generated based on demand. The exact location of the activation switches for the AFFF systems are TBD. The 6% AFFF is piped into overhead sprinkling systems in the protected spaces except for the Engine Room which is equipped with a bilge sprinkling system.

4. Mod 1 Pump

The P-250 Mod 1 pump is stowed forward of the Buoy Deck on the port side of the Main Deck. The portable gasoline cans for this pump are stowed aft on the starboard side of the 01 Deck.

5. Portable fire extinguishers

PKP and CO_2 portable extinguishers are installed throughout the cutter as shown in Table C.3.

Table C.3 Portable Fire Extinguishers (page 1 of 2)

Plan ID	Compartment Name	Manual Firefighting Portable Extinguishers
CUI=AA	**(Cargo Holds)**	
2-24-0-AA	CARGO HOLD	1 CO_2/1 PKP
CUI=AG	**(Gear Lockers)**	
2-4-1-A	CHAIN LKR	1 PKP
2-4-2-A	CHAIN LKR	1 PKP
1-0-0-Q	BOATSWAIN STRM	1 PKP
1-61-1-Q	REPAIR LKR	2 PKP
1-76-1-A	CLEANING GEAR LOCKER	2 PKP
01-53-1-A	CLEANING GEAR LOCKER	1 CO_2/2 PKP
01-67-1-A	LINEN LOCKER	1 PKP
01-70-1-Q	BOAT LKR	2 PKP
01-83-4-Q	TRASH LKR	1 PKP
02-61-1-Q	PFD LKR	2 CO_2
02-61-2-Q	PFD LKR	2 CO_2/2 PKP
02-68-1-Q	BATTERY LKR	1 CO_2
CUI=AS	**(Storerooms)**	
3-47-1-Q	ENGRS STRM	1 CO_2/1 PKP
3-52-1-Q	ELEC/ELEX STRM	1 CO_2/1 PKP
1-77-1-A	SODA LKR	2 PKP
CUI=C	**(Ship Control, Communication)**	
3-52-0-C	ENGINEERING CONTROL CTR	1 CO_2/1 PKP
01-50-0-C	BUOY DECK CONTROL ROOM	1 CO_2/2 PKP
02-52-0-C	PILOTHOUSE	1 CO_2/1 PKP
CUI=EM	**(Main Propulsion-Mechanical)**	
3-6-0-E	BOW THRUSTER ROOM	1 CO_2
3-61-0-E	MAIN ENGINE ROOM	2 CO_2/2 PKP
CUI=K	**(Hazardous Material Storage)**	
1-6-3-Q	PAINT LKR	1 CO_2/2 PKP
CUI=L1	**(Senior Officer's Cabin)**	
01-52-1-L	CO CABIN	3 PKP
01-62-1-L	CO SR	3 PKP
CUI=L2	**(Officer/CPO Quarters)**	
01-52-2-L	CPO SR (1)	3 PKP
01-61-2-L	CPO SR (1)	3 PKP
CUI=L5	**(Crews Berthing)**	
1-79-1-L	ENLISTED SR (4)	2 PKP
1-79-2-L	ENLISTED SR (3+1)	2 PKP
01-68-2-L	PO SR (2+2)	3 PKP
01-76-0-L	ENLISTED SR (4)	3 PKP
01-76-2-L	ENLISTED SR (2+2)	3 PKP
CUI=LL	**(Wardroom/ Mess/ Lounge Area)**	
1-61-0-L	MESS ROOM	2 PKP

Table C.3 Portable Fire Extinguishers (page 2 of 2)		
Plan ID	Compartment Name	Manual Firefighting Portable Extinguishers
CUI=LP	**(Passageway/Staircase/Vestibule)**	
3-35-0-Q	PASSAGE	1 PKP
1-52-0-L	PASSAGE	1 PKP
1-52-1-L	COMPANIONWAY	4 PKP
1-79-0-L	COMPANIONWAY	1 CO_2/2 PKP
1-79-01-L	PASSAGE	2 PKP
01-55-0-L	PASSAGE	1 PKP
01-61-1-L	COMPANIONWAY	2 PKP
02-58-1-L	LADDER	1 CO_2/1 PKP
CUI=LW	**(Sanitary Spaces)**	
1-83-0-L	ENLISTED WR,WC&SH	1 PKP
1-83-2-L	ENLISTED WR,WC&SH	1 PKP
01-58-2-L	CPO WR,WC	2 PKP
01-66-1-L	CO WR,WC SHR	1 PKP
01-74-2-L	ENLISTED WR,WC&SH	2 PKP
01-83-2-L	ENLISTED WR,WC&SH	1 PKP
CUI=QA	**(Aux Machinery Spaces)**	
3-15-0-E	HYDRAULIC EQPT RM	1 CO_2/2 PKP
3-42-1-Q	POTABLE WATER EQPT RM	1 CO_2/1 PKP
3-79-0-Q	PUMP ROOM	1 CO_2/2 PKP
3-88-0-E	PROPULSION THRUSTER RM	1 CO_2
CUI=QE	**(Emergency Aux Generator Rm)**	
02-68-2-E	EMERGENCY GEN RM	1 CO_2/2 PKP
CUI=QF	**(Fan Room)**	
02-52-0-V	VOID	1 PKP
CUI=QG	**(Galley/ Pantry/ Scullery)**	
1-61-2-Q	GALLEY	2 PKP
1-76-2-Q	SCULLERY	2 PKP
CUI=QL	**(Laundry)**	
1-52-3-Q	CHANGE RM	1 PKP
1-58-1-Q	LAUNDRY	1 PKP
CUI=QO	**(Office Spaces)**	
1-52-2-Q	SHIP'S OFFICE	1 PKP
1-57-2-Q	ENG OFFICE AND DC CENTRAL	1 PKP
02-61-0-C	CHART ROOM	1 CO_2/1 PKP
CUI=QS	**(Shops)**	
3-42-0-Q	MACHINE SHOP	1 CO_2/1 PKP
3-57-1-Q	ELEC SHOP	1 CO_2/1 PKP
1-6-1-Q	SERVICE LKR	1 CO_2/2 PKP
1-6-2-Q	ATON SHOP	1 CO_2/2 PKP
CUI=TU	**(Stacks/ Engine Uptakes)**	
1-70-1-Q	UPTAKE	2 CO_2/2/PKP
02-70-0-Q	STACK	None
CUI=V	**(Voids/ Cofferdams)**	
3-0-0-V	FOREPEAK	None
All	VOIDS	None
CUI=W	**(Water Tank)**	
3-35-1-W	BALLAST TANK	None
3-35-2-W	BALLAST TANK	None
3-81-1-W	GRAY WTR HOLDING TNK	None
2-44-0-W	FRESH WATER TANK	None

6. Protective Equipment

{Quantity TBD} Navy Type A-4 oxygen breathing apparatus (OBA) and {Quantity TBD} firefighting ensembles (FFE) are stowed in the cutter. There are {Quantity TBD} canisters per OBA. The location of OBAs and FFEs are TBD.

III. Firefighting Procedures

In this section 19 different shipboard fire scenarios are described. The recommended procedures for fighting each fire are detailed, from the alarm through post-fire activities. The last procedure is for fires in port.

A. Emergency Generator Room

1. Scenario

The most likely fire in this compartment is a class B fire due to a ruptured lube oil or fuel oil line on the Emergency Generator Diesel Engine. There is also a significant possibility that a class C fire may occur in the emergency generator or associated switchboard located in this space.

2. Confining the Fire

The fire boundaries are bulkhead 68 forward, the superstructure port and aft, the longitudinal centerline bulkhead to starboard, and the 02 deck. Note, the Stack and the Battery Locker prevent access to this compartment from the starboard side. The Pyro Locker is located on the port side weather deck adjacent to this compartment. If time and conditions permit, the contents of this locker should be relocated as far aft as possible on the weather decks or jettisoned overboard. The Emergency Generator Room supply and exhaust fans shall be secured and the remote fuel trip for the emergency generator should be activated to ensure the fuel supply to the emergency generator is secured.

3. Sizeup

The Emergency Generator Room in this cutter is normally unmanned, therefore it unlikely that personnel will need to be rescued. Class B combustibles are best extinguished by AFFF. Experience has shown that flammable liquid spray fires are extremely difficult to extinguish unless the pressurized source of fuel can be secured. This space is protected with a fixed CO_2 fire extinguishing system. Class C fires are best extinguished with CO_2. This agent has limited effect on flammable liquid fires since it has minimal cooling effect and is not persistent (such as AFFF), therefore reflashes are common.

4. First Aid

If the fire is discovered when it is small enough to attempt first aid the person discovering the fire should use a PKP portable fire extinguisher on a class B fire and a CO_2 portable extinguisher on a class C fire. As noted above, high priority should be given to securing pressurized sources of fuel.

5. Indirect Attack

If the compartment can be completely isolated, a class B or class C fire may be indirectly attacked with minimal risk to personnel by shutting down the emergency

generator, and ventilation fans; evacuating the space; securing electrical power to affected electrical equipment (class C fires) or securing the pressurized fuel source to the emergency generator (class B fires) and activating the installed CO_2 total flooding system. The scene leader and investigator shall monitor the effectiveness of the CO_2 by monitoring bulkhead temperatures and other appropriate means. The scene leader may direct re-entry in accordance with the direct attack procedures described in the next section after waiting a minimum of 15 minutes for the temperature to cool below the ignition point.

6. Direct Attack

For class B fires or following activation of the installed CO_2 flooding system, and when the scene leader directs, #1 firefighting hose team should enter through the weathertight door from the port weather 02 deck with a 1.5" fire hose configured to apply AFFF. The #2 firefighting hose team should back up the first team and enter through the same door with a 1.5" fire hose configured to dispense AFFF. The bilges shall be blanketed with a minimum of 1/2 inch AFFF. The #1 and #2 nozzlemen should be dressed out in FFEs and should not enter the space without an OBA. The #1 and #2 hose tenders should wear an OBA but they should not enter the space. A class C fire shall be attacked directly, by first securing the source of electrical power, then attacking the remaining class A or B fire with PKP or CO_2 portable extinguishers.

7. Post-fire Activities

Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA. Operate the supply and exhaust fans on high for at least 15 minutes after the engine room atmosphere has been tested and proven free of flammable gases.

8. Other Actions

During firefighting actions the investigator wearing an OBA shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 shall be rigged as a backup source of firefighting water. The electrician should secure electrical power with the exception of lighting to the Emergency Generator Room. The covers should be installed over the Emergency Generator Room exhaust louvers and if available over the supply vent intakes. The contents of the pyrotechnics locker shall be relocated aft on the main weather deck.

B. Pilothouse/Chart Room

1. Scenario

The most likely fire in this compartment is a class C fire in energized electronic or electrical equipment such as the radar. There is also a significant possibility of a class A fire in ordinary combustibles such as charts and logbooks in the Chart Room.

2. Confining the Fire

The fire boundaries are the superstructure forward, port and starboard and bulkhead 68 aft, and the 02 deck. Note, the PFD lockers prevent access to the Chart Room from port or starboard weather decks The short inclined ladder between the Chart Room and Pilothouse can not be secured, therefore it is likely that fire will spread to involve both compartments. The Chart Room is also accessible from the 01 Deck longitudinal Passageway up an inclined ladder and through a joiner door. In the event of a fire in the Chart Room or Bridge this door should not be opened to prevent the spread of smoke and flames into the interior of the ship.

3. Sizeup

The Bridge is continuously manned underway and frequently occupied in port. Due to the likelihood that crewmembers in this space are awake and alert, and the ease of egress to weather, there is little possibility that personnel may need to be rescued. Class C fires are usually extinguished when electrical power is secured, however a class A fire may be burning in conjunction with the equipment that was the cause of the class C fire.

4. First Aid

If the fire is discovered when it is small enough to attempt first aid the person discovering the fire should use a CO_2 portable fire extinguisher on class C fires and a PKP portable extinguisher on Class A fires.

5. Indirect Attack.

Due to the open ladder from the Chart Room to the Bridge and the lack of installed fixed flooding systems, an indirect attack is not feasible especially in the Chart Room. Fires in the Bridge may be indirectly attacked through a Pilothouse window. Use a 1.5" fire hose equipped with a vari nozzle to cool the superstructure and other fire boundaries as needed.

6. Direct Attack

Class C fires in this space should be attacked by securing the electrical power to the affected equipment first and then attacking the remaining class A fire directly (charged capacitors in electronic equipment may retain a significant electrical charge after power is secured). The #1 firefighting hose team should enter the Bridge through the weathertight door on the port or starboard side of the Bridge from the 02 weather deck and proceeding into the Chart Room down the open ladder from the Bridge with a 1.5" fire hose equipped with a vari nozzle set to the water fog position. The #2 firefighting hose team should back up the first team and enter through the opposite weathertight door with a 1.5" fire hose equipped with a vari nozzle set to the water fog position. The #1 and #2 nozzlemen should be dressed out in FFEs and should not enter the space without an OBA. The #1 and #2 hose tenders should wear an OBA but they should not enter the space.

7. Post-fire Activities

Smoldering materials should be jettisoned, with the Commanding Officer's permission, overboard or soaked in a bucket of water on the weather deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

8. Other Actions

During firefighting actions the investigator wearing an OBA shall continually inspect the fire boundaries to ensure the fire has not spread. The Emergency Generator shall be started and left in stand-by as a potential source of electrical power. The electrician should secure electrical power with the exception of lighting to the Bridge.

C. PFD Locker

1. Scenario

The most likely fire in this compartment is a class A fire in the personal flotation devices stowed in this compartment.

2. Confining the Fire

The fire boundaries are the superstructure outboard and aft, the Chart Room inboard, the Pilothouse forward, and the 02 Deck. The Pyro Locker is outboard of the port PFD Locker. If time and conditions permit the contents of the Pyro locker should be relocated as far aft as possible on the 01 Deck.

3. Sizeup

These spaces are not manned and there is no need to consider the possibility of trapped personnel. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

4. First Aid

If the fire is discovered when it is small enough to attempt first aid the person discovering the fire should use a PKP portable fire extinguisher.

5. Indirect Attack

Due to the nature of these compartments an indirect attack is not feasible. Use a 1.5" fire hose equipped with a vari nozzle to cool the 02 deck, the Pyro Locker (if relocating its contents was not feasible) and other fire boundaries as needed.

6. Direct Attack

When the scene leader directs, the #1 firefighting hose team should approach the door to the PFD Locker with a 1.5" fire hose equipped with a vari nozzle set to the water

fog position. The #2 firefighting hose team should back up the first team with a 1.5" fire hose equipped with a vari nozzle set to the water fog position. The #1 and #2 nozzlemen should be dressed out in FFEs and an OBA. The #1 and #2 hose tenders should also wear an OBA. The fire should be attacked directly through the weathertight door to the PFD Locker.

7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the weather deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

8. Other Actions

During firefighting actions the investigator, wearing an OBA, shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 shall be rigged on the weather deck aft as a backup source of firefighting water. The contents of the pyro locker should be relocated aft on the 01 deck

D. Stack/Uptake

1. Scenario

The most likely fire in this compartment is a combination class A/B fire in lube oil soaked insulation on the exhaust pipes in the stack/uptake.

2. Confining the Fire

The fire boundaries are the Stack boundaries. All engines exhausting through the affected stack and uptake should be immediately secured. The other stack will be needed to ensure the cutter can maneuver and produce electrical power for the fire pumps. Therefore ventilation should only be secured in the affected stack/uptake. Do not install the stack vent covers since an indirect attack may be made through the louvers.

3. Sizeup

The Engine Room in this cutter is normally unmanned, and the ease of egress fore and aft make it unlikely that personnel will need to be rescued. There are no EEBDs in the space but personnel may escape through the escape scuttles located in the overhead. Class B combustibles are best extinguished by AFFF or water fog. Class A fires are best extinguished with water.

4. First Aid

If the fire is discovered when it is small enough to attempt first aid the person discovering the fire should use a PKP portable fire extinguisher on a class A or B fire.

5. Indirect Attack

A combination class A/B fire may be indirectly attacked with minimal risk to personnel by shutting down the main engines, generators, and ventilation fans; served by the affected stack; and attacking the fire through the ventilation louvers with AFFF or water fog. If the scene leader declares the fire to be out of control the fire should be attacked following the procedures for an out off control class B fire in the Engine Room as discussed in paragraph III P below.

6. Direct Attack

When the scene leader directs, #1 firefighting hose team should approach the affected stack from the 02 weather deck and apply AFFF or water fog through the ventilation louvers. The #2 firefighting hose team should back up the first team and apply additional agent through the same louvers. The #1 and #2 nozzlemen should be dressed out in FFEs and should wear an OBA. The #1 and #2 hose tenders should also wear an OBA.

7. Post-fire Activities

Conduct atmospheric testing for oxygen and toxic gas levels before entering the Engine Room without an OBA. Operate the supply and exhaust fans on high for at least 15 minutes after the engine room atmosphere has been tested and proven free of flammable gases.

8. Other Actions

During firefighting actions the investigator wearing an OBA shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 shall be rigged as a backup source of firefighting water. The electrician should secure electrical power with the exception of lighting and the fire pump to the Engine Room.

E. Enlisted Berthing, 01 Deck

1. Scenario

The most likely fire in one of the staterooms on the 01 deck is a class A fire in bedding materials.

2. Confining the Fire

The joiner doors to staterooms above the Main Deck have open louvers for ventilation. Therefore, confining the fire to a particular room in the superstructure is difficult. The fire boundaries for 01 Deck staterooms are the superstructure, the 01 deck and the 02 deck. Note this includes the 01 Deck Passageway outside the staterooms, as well as The Commanding Officer's Quarters, the Chief Petty Officer's Quarters and the Buoy Deck Control Room.

3. Sizeup

Due to the likelihood of sleeping crewmembers in these spaces there is a strong possibility that personnel may need to be rescued. There are no EEBDs in the spaces and personnel must escape through the 01 Deck Passageway outside the staterooms. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

4. First Aid

If the fire is discovered when it is small enough to attempt first aid the person discovering the fire should use a PKP portable fire extinguisher.

5. Indirect Attack

Due to the inability to completely isolate the compartments in the superstructure an indirect attack is not feasible. Use a 1.5" fire hose equipped with a vari nozzle to cool the 01 and 02 Decks and other fire boundaries as needed.

6. Direct Attack

The #1 firefighting hose team should enter the 01 Deck Passageway through the windward weather door from the 01 Weather Deck with a 1.5" fire hose equipped with a vari nozzle set to the water fog position and proceed to the affected stateroom. The #2 firefighting hose team should back up the first team and enter through the same weathertight door in the 01 Deck Passageway with a 1.5" fire hose equipped with a vari nozzle set to the water fog position. The #1 and #2 nozzlemen should be dressed out in FFEs and should not enter the space without an OBA. The #1 and #2 hose tenders should wear an OBA but they should not enter the space.

7. Post-fire Activities

Smoldering materials should be jettisoned, with the Commanding Officer's permission, overboard or soaked in a bucket of water on the weather deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

8. Other Actions

During firefighting actions the investigator wearing an OBA shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 shall be rigged as a backup source of firefighting water. The electrician should secure electrical power with the exception of lighting to the staterooms on the 01 Deck.

F. Buoy Deck Control Room

1. Scenario

The most likely fire in this compartment is a class B fire due to a ruptured hydraulic oil line in the console controlling the boom.

2. Confining the Fire

This compartment is stepped between the 01 deck and the 02 Deck at the forward end of the superstructure. Due to ventilation louvers in the joiner doors to compartments above the main deck, fire boundaries are expanded to include all compartments on the affected deck. The fire boundaries thus include the superstructure, 02 Deck and Main Deck. Class B flammable liquid fires from pressurized sources are extremely difficult to extinguish unless the pressurized source of fuel can be secured. Potential sources of pressurized flammable liquids in the Buoy Deck Control Room include hydraulic oil in the console to control the buoy handling crane. The associated hydraulic pumps are located in the Hydraulic Equipment Room. Highest priority should be assigned to secure these pump(s) in the event of a class B fire in the Buoy Deck Control Room.

3. Sizeup

Due to the likelihood that crewmembers in this space are awake and alert, and the ease of egress port, starboard and aft, there is little possibility that personnel may need to be rescued. Class B fires are efficiently extinguished with 6% AFFF.

4. First Aid

If the fire is discovered when it is small enough to attempt first aid the person discovering the fire should use a PKP portable extinguisher on Class B fires.

5. Indirect Attack.

There is no installed fire extinguishing system in this space therefore an indirect attack is not feasible.

6. Direct Attack

Class B fires in the Buoy Deck Control Room should be attacked by first securing the source of pressurized flammable liquids. Therefore the hydraulic pumps in the Hydraulic Equipment Room should be immediately secured. To prevent flames and smoke from entering the interior of the cutter, the aft joiner door in the Buoy Deck Control Room leading to the 01 Deck Passageway should <u>not</u> be opened. When the scene leader directs, #1 firefighting hose team should open the windward weathertight door to the Buoy Deck Control Room from the Buoy Deck and apply 6% AFFF with a 1.5" fire hose through the open door without entering the space. The #2 firefighting hose team should back up the first team and apply 6% AFFF through the same door with a 1.5" fire hose configured to apply 6% AFFF. The space is small and should not be entered by either hose team unless absolutely necessary. The #1 and #2 nozzlemen should be dressed

out in FFEs and should not enter the space without an OBA. The #1 and #2 hose tenders should wear an OBA but they should not enter the space.

7. Post-fire Activities

Smoldering materials should be jettisoned, with the Commanding Officer's permission, overboard or soaked in a bucket of water on the weather deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

8. Other Actions

During firefighting actions the investigator wearing an OBA shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 shall be rigged as a backup source of firefighting water. The electrician should secure electrical power with the exception of lighting to the Buoy Deck Control Room.

G. Paint Locker

1. Scenario

The most likely fire in this compartment is a class B fire in the paint and other flammable liquids stowed in this compartment.

2. Confining the Fire

The fire boundaries are bulkhead 6 forward, bulkhead 15 aft, the main deck, and hull. The ventilation fans for the Paint Locker shall be secured. The oxygen and acetylene bottles stowed on the starboard side forward on the Buoy Deck should be relocated as far aft on the 01 Weather Deck as possible if time and manpower permit.

3. Sizeup

The Paint Locker in this cutter is normally unmanned, therefore it is unlikely that personnel will need to be rescued. Class B flammable liquids are efficiently extinguished by 6% AFFF, however an installed CO_2 total flooding system is also effective if the compartment can be completely isolated to prevent loss of the agent.

4. First Aid

If the fire is discovered when it is small enough to attempt first aid the person discovering the fire should use a PKP portable fire extinguisher on a class B fire.

5. Indirect Attack

If the compartment can be completely isolated, a class B fire in the Paint Locker may be indirectly attacked with minimal risk to personnel by shutting down the ventilation fans; evacuating the space; and activating the installed CO_2 total flooding system. The scene leader and investigator shall monitor the effectiveness of the CO_2 by monitoring bulkhead temperatures and other appropriate means. The scene leader may direct re-entry

in accordance with the direct attack procedures described in the next section after waiting a minimum of 15 minutes for the temperature to cool below the ignition point.

6. Direct Attack

When the scene leader directs, #1 firefighting hose team should enter the Paint Locker through the watertight door from the Service Locker with a 1.5" fire hose configured to apply 6% AFFF. The #2 firefighting hose team should back up the first team through the same door with a 1.5" fire hose configured to apply AFFF. The bilges shall be blanketed with a minimum of 1/2 inch AFFF. The #1 and #2 nozzlemen should be dressed out in FFEs and should not enter the space without an OBA. The #1 and #2 hose tenders should wear an OBA but they should not enter the space.

7. Post-fire Activities

Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA. Operate the supply and exhaust fans on high for at least 15 minutes after the Paint Locker atmosphere has been tested and proven free of flammable gases.

8. Other Actions

During firefighting actions the investigator wearing an OBA shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 shall be rigged as a backup source of firefighting water. The electrician should secure electrical power with the exception of lighting to the Paint Locker. The oxygen and acetylene bottles stored forward on the Buoy Deck should be relocated aft on the Buoy Deck if time and manpower permits.

H. Mess Room/Galley

1. Scenario

The most likely fire in this compartment is a class A fire in the upholstered seats in the mess deck. There is a significant possibility of a class B grease fire in the galley on the stove. There is also a significant possibility of a class C fire in the electronic/electrical recreational equipment in the mess deck such as the TV or VCR.

2. Confining the Fire

The fire boundaries are bulkhead 61 forward, bulkhead 79 aft, the main Deck and 01 Deck. Note this includes both the Mess Deck and the Galley area. The Dry Stores and Scullery are also located within these boundaries.

3. Sizeup

Due to the likelihood that crewmembers in this space are awake and alert, and the ease of egress forward, aft, and below, there is little possibility that personnel may need to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is

minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured. Class C fires are usually extinguished when electrical power is secured, however a class A fire may be burning in conjunction with the equipment that was the cause of the class C fire. Class B fires are efficiently extinguished with PKP if the fire is small and 6% AFFF if the fire is larger. The installed aqueous potassium carbonate system is also effective against a class B grease fire on the galley stove.

4. First Aid

If the fire is discovered when it is small enough to attempt first aid the person discovering the fire should use a PKP portable fire extinguisher on class A and B fires and a CO_2 portable extinguisher on Class C fires. The installed aqueous potassium carbonate system should be immediately activated in the event of a grease fire on the galley stove.

5. Indirect Attack

A grease fire on the galley stove can be effectively extinguished by activating the installed aqueous potassium carbonate fire extinguishing system. Since there is no installed fixed firefighting system and due to the configuration of the compartmentation in this part of the cutter, an indirect attack on class A and class C fires in these spaces is not feasible. Use a 1.5" fire hose equipped with a vari nozzle to cool the fire boundaries as needed.

6. Direct Attack

Class A fires in these spaces should be attacked directly; the #1 firefighting hose team should enter the Mess Deck/Galley through the forward watertight door in the Mess Deck from the Main Deck Passageway with a 1.5" fire hose equipped with a vari nozzle set to the water fog position. The #2 firefighting hose team should back up the first team and enter from the Main Deck Passageway through the same door with a 1.5" fire hose equipped with a vari nozzle set to the water fog position. The #1 and #2 nozzlemen should be dressed out in FFEs and should not enter the space without an OBA. The #1 and #2 hose tenders should wear an OBA but they should not enter the space. The other doors serving the Mess Deck/Galley should not be opened until the fire is completely out and the atmosphere tested safe. Class B fires not extinguished by the installed aqueous potassium carbonate system should be attacked directly with PKP portable extinguishers if the fire is small and confined to the stove area in the galley. If the class B fire has spread, the fire should be attacked directly with water fog or preferably 6% AFFF. Class C fires should be extinguished with a portable CO_2 extinguisher after the electrical power to the affected equipment is secured.

7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the weather deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

8. Other Actions

During firefighting actions the investigator, wearing an OBA, shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 shall be rigged on the weather deck as a backup source of firefighting water. The electrician should secure electrical power with the exception of lighting to the Mess Deck, Galley, Dry Stores and Scullery.

I. Ship's Office

1. Scenario

The most likely fire in this compartment is a class C fire in the electronics equipment such as the copy machine or uninterruptible power supply (UPS) for the computer located in this space. There is also a significant possibility of a class A fire in conjunction with the class C fire due to the quantity of papers and files stowed in this space.

2. Confining the Fire

The fire boundaries are bulkhead 52 forward and bulkhead 61 aft, Main Deck and 01 Deck.

3. Sizeup

Due to the likelihood that crewmembers in this space are awake and alert, and the ease of egress to weather, there is little possibility that personnel may need to be rescued. Class C fires are effectively extinguished with CO_2, however it is imperative that electrical power to the affected energized equipment is secured.. A class A fire may be burning in conjunction with the equipment that was the cause of the class C fire class A fires are effectively extinguished with water fog or with a portable PKP if the fire is small.

4. First Aid

If the fire is discovered when it is small enough to attempt first aid the person discovering the fire should use a CO_2 portable fire extinguisher on class C fires and a PKP portable extinguisher on Class A fires.

5. Indirect Attack.

Since there is no installed firefighting system and due to the configuration of the compartmentation in this part of the cutter an indirect attack is not feasible. Use a 1.5" fire hose equipped with a vari nozzle to cool the fire boundaries as needed.

6. Direct Attack

Class C fires in this space should be attacked by securing the electrical power to the affected equipment first and then attacking the remaining class A fire directly (charged capacitors in electronic equipment may retain a significant electrical charge after power is secured). The #1 firefighting hose team should enter the watertight door to the Main

Deck Passageway from the Buoy Deck and proceed to the Ship's Office through the Main Deck Passageway with a 1.5" fire hose equipped with a vari nozzle set to the water fog position. The #2 firefighting hose team should back up the first team and use the same attack route with a 1.5" fire hose equipped with a vari nozzle set to the water fog position. The #1 and #2 nozzlemen should be dressed out in FFEs and should not enter the space without an OBA. The #1 and #2 hose tenders should wear an OBA but they should not enter the space.

7. Post-fire Activities

Smoldering materials should be jettisoned, with the Commanding Officer's permission, overboard or soaked in a bucket of water on the weather deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

8. Other Actions

During firefighting actions the investigator wearing an OBA shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 shall be rigged as a backup source of firefighting water. The electrician should secure electrical power with the exception of lighting to the Ship's Office.

J. Stateroom 1-79-2-L

1. Scenario

The most likely fire in this compartment is a class A fire in bedding materials in this stateroom.

2. Confining the Fire

The fire boundaries are bulkhead 79 forward and bulkhead 88 aft, Main Deck and 01 Deck.

3. Sizeup

Due to the likelihood of sleeping crewmembers in this space and the lack of emergency egress from this compartment there is a strong possibility that personnel may need to be rescued. Highest priority should be given to the rescue of sleeping or trapped crewmembers. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

4. First Aid

If the fire is discovered when it is small enough to attempt first aid the person discovering the fire should use a PKP portable fire extinguisher.

5. Indirect Attack

There is no fixed fire extinguishing system installed in this space and due to the configuration of the compartmentation in this part of the cutter an indirect attack is not feasible. Use a 1.5" fire hose equipped with a vari nozzle to cool the fire boundaries as needed.

6. Direct Attack

When the scene leader directs the #1 and #2 firefighting hose team should proceed to Stateroom 1-79-2-L using the following attack route: from the Mess Deck through the Companionway aft of the Mess Deck and two watertight doors into the transverse Main Deck Passageway and through the joiner door to Stateroom 1-79-2-L with a 1.5" fire hose equipped with a vari nozzle set to the water fog position. The #2 firefighting hose team should back up the first team with a 1.5" fire hose equipped with a vari nozzle set to the water fog position. The #1 and #2 nozzlemen should be dressed out in FFEs and should not enter the space without an OBA. The #1 and #2 hose tenders should wear an OBA but they should not enter the space.

7. Post-fire Activities

Smoldering materials should be jettisoned, with the Commanding Officer's permission, overboard or soaked in a bucket of water on the weather deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

8. Other Actions

During firefighting actions the investigator wearing an OBA shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 shall be rigged as a backup source of firefighting water. The electrician should secure electrical power in Stateroom 1-79-2-L with the exception of lighting.

K. Bow Thruster Room

1. Scenario

The most likely fire in this compartment is a class C fire in the electric controller or bow thruster motor. A class B fire is also likely in the grease and oil associated with the bow thruster motor and drive train to the propeller located in an enclosed tunnel below the space.

2. Confining the Fire

The fire boundaries are Bulkhead 6 forward and bulkhead 15 aft, the hull and the Main Deck. The Paint Locker is directly above this space on the starboard side. Preparations should be made to activate the installed CO_2 system in the Paint Locker. The oxygen and acetylene bottles stowed on the starboard side forward on the Buoy Deck should be relocated as far aft as possible on the 01 Weather Deck.

3. Sizeup

This space is not manned, and there is very little possibility that personnel may need to be rescued. Class C fires are usually extinguished when electrical power is secured, however a class A fire may be burning in conjunction with the equipment that was the cause of the class C fire. Class B fires are effectively extinguished with 6% AFFF. This space is also protected by an installed AFFF overhead sprinkling system.

4. First Aid

If the fire is discovered when it is small enough to attempt first aid the person discovering the fire should use a CO_2 portable fire extinguisher on Class C fires and a PKP portable extinguisher on Class A fires.

5. Indirect Attack.

If the space can be completely isolated, a class B fire in the Bow Thruster Room can be attacked indirectly with minimal danger to personnel by activating the installed 6% AFFF sprinkling system. If the electrical power to affected machinery can be secured, a residual class A fire can also be effectively attacked with the installed 6% AFFF system. When the scene leader directs re-entry procedures should be in accordance with the direct attack procedures in the next section. If the installed 6% AFFF system fails to extinguish the fire, the fire may be indirectly attacked through the scuttle in the ATON Shop above the Bow Thruster Room on the port side. If the scene leader directs such an attack, use a 1.5" fire hose equipped with a vari-nozzle set to the water fog position and insert the hose through the scuttle. Use a 1.5" fire hose equipped with a vari nozzle to cool the Main Deck and other fire boundaries as needed.

6. Direct Attack

When the scene leader directs, the #1 firefighting hose team should enter the Bow Thruster Room through the watertight door on the starboard side from the Hydraulic Equipment Room with a 1.5" fire hose equipped with a vari nozzle set to the water fog position. The #2 firefighting hose team should back up the first team and enter the Bow Thruster Room through the same watertight door with a 1.5" fire hose equipped with a vari nozzle set to the water fog position. The #1 and #2 nozzlemen should be dressed out in FFEs and should not enter the space without an OBA. The #1 and #2 hose tenders should wear an OBA but they should not enter the space.

7. Post-fire Activities

Smoldering materials should be jettisoned, with the Commanding Officer's permission, overboard or soaked in a bucket of water on the weather deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

8. Other Actions

During firefighting actions the investigator wearing an OBA shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 shall be rigged as a backup source of firefighting water. The electrician should secure electrical power with the exception of lighting to the Bow Thruster Room.

L. Hydraulic Equipment Room

1. Scenario

The most likely fire in this compartment is a class B fire due to a ruptured hydraulic oil line in this space.

2. Confining the Fire

The fire boundaries are bulkhead 15 forward, bulkhead 24 aft, the main deck and hull. Class B flammable liquid fires from pressurized sources are extremely difficult to extinguish unless the pressurized source of fuel can be secured. Potential sources of pressurized flammable liquids in the Hydraulic Equipment Room include hydraulic oil in the high pressure piping from the hydraulic pumps to the buoy handling crane on the Buoy Deck. The hydraulic pumps are located in the Hydraulic Equipment Room. Highest priority should be assigned to secure these pump(s) in the event of a class B fire in the Hydraulic Equipment Room. The Paint Locker is above and forward of this space on the starboard side. Preparations should be made to activate the installed CO_2 system in the Paint Locker. The oxygen and acetylene bottles stowed on the starboard side forward on the Buoy Deck should be relocated as far aft as possible on the 01 Weather Deck.

3. Sizeup

This is an unmanned space, thus there is little possibility that personnel may need to be rescued. Class B combustibles are effectively extinguished by water fog or 6% AFFF. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

4. First Aid

If the fire is discovered when it is small enough to attempt first aid the person discovering the fire should use a PKP portable fire extinguisher on class B fires.

5. Indirect Attack

If the compartment can be completely isolated a class B fire may be indirectly attacked with minimal risk to personnel by applying 6% AFFF from a 1.5" hose equipped with a vari nozzle through the 21" emergency escape scuttle on the port side of the Buoy Deck. When the scene leader directs re-entry procedures should be in accordance with direct attack procedures described in the next section. Use a 1.5" fire hose equipped with a vari nozzle to cool the main deck and other fire boundaries as needed. The oxygen and

acetylene bottles stowed forward on the Buoy Deck should be relocated aft on the 01 Weather Deck if time and manpower permits.

6. Direct Attack

When the scene leader directs, the #1 firefighting hose team should enter the Hydraulic Equipment Room through the watertight door from the Cargo Hold with a 1.5" fire hose equipped with a vari nozzle configured to apply 6% AFFF on a class B fire. The #2 firefighting hose team should back up the first team and enter through the same door with a 1.5" fire hose equipped with a vari nozzle configured for 6% AFFF. The #1 and #2 nozzlemen should be dressed out in FFEs and should not enter the space without an OBA. The #1 and #2 hose tenders should wear an OBA but they should not enter the space.

7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the weather deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

8. Other Actions

During firefighting actions the investigator wearing an OBA shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 shall be rigged as a backup source of firefighting water. The electrician should secure electrical power to the Hydraulic Equipment Room.

M. Cargo Hold

1. Scenario

The most likely fire in this compartment is a class A fire in ordinary combustibles stowed in this space.

2. Confining the Fire

The fire boundaries are bulkhead 24 forward, bulkhead 35 aft, the main deck and hull. The watertight door to the Hydraulic Equipment Room should remain closed to prevent any possibility of flames spreading to a compartment with a significant class B fire threat. The oxygen and acetylene bottles stowed on the Buoy Deck above should be relocated aft to the 01 Weather Deck if time and manpower permits.

3. Sizeup

This is an unmanned space, thus there is little possibility that personnel may need to be rescued. Class A combustibles are best extinguished by water fog Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

4. First Aid

If the fire is discovered when it is small enough to attempt first aid the person discovering the fire should use a PKP portable fire extinguisher on class A and class B fires and a CO_2 portable extinguisher on Class C fires.

5. Indirect Attack

If the compartment can be completely isolated the fire may be indirectly attacked with minimal risk to personnel by applying water fog from a 1.5" hose equipped with a vari nozzle through the buoy chain ports on the Buoy Deck. If this attack is ineffective, or if the scene leader directs that a direct attack on the fire shall be attempted, the procedures in the next section for direct attack should be followed. Use a 1.5" fire hose equipped with a vari nozzle to cool the main deck and other fire boundaries as needed.

6. Direct Attack

A direct attack on Class A fires in this spaces is not recommended, however if the scene leader directs the preferred access to the compartment is from the Machine Shop through the longitudinal Passageway and two watertight doors into the Cargo Hold. Do not attempt entry from the Hydraulic Equipment Room. The #1 firefighting hose team should enter the Cargo Hold from the Machine Shop and through the longitudinal Main Deck Passageway and two watertight doors with a 1.5" fire hose equipped with a vari nozzle set to the water fog position. The #2 firefighting hose team should back up the first team and follow the same attack route as the first team with a 1.5" fire hose equipped with a vari nozzle set to the water fog position. The #1 and #2 nozzlemen should be dressed out in FFEs and should not enter the space without an OBA. The #1 and #2 hose tenders should wear an OBA but they should not enter the space.

7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the weather deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

8. Other Actions

During firefighting actions the investigator wearing an OBA shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 shall be rigged as a backup source of firefighting water. The electrician should secure electrical power with the exception of lighting to the Cargo Hold.

N. Machine Shop

1. Scenario

The most likely fire in this compartment is a combination class A/B fire in oily rags in the rag barrel.

2. Confining the Fire

The fire boundaries are bulkhead 42 forward, bulkhead 52 aft, the main deck and hull.

3. Sizeup

This is an unmanned space, thus there is little possibility that personnel may need to be rescued. Class A combustibles are best extinguished by water fog Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured. Class B fires are effectively extinguished with portable PKP extinguishers if the fire is small and with 6% AFFF if larger.

4. First Aid

If the fire is discovered when it is small enough to attempt first aid the person discovering the fire should use a PKP portable fire extinguisher on class A and class B fires and a CO_2 portable extinguisher on Class C fires.

5. Indirect Attack

If the compartment can be completely isolated the fire may be indirectly attacked with minimal risk to personnel by applying water fog from a 1.5" hose equipped with a vari nozzle through the 30" x 30" quick-acting hatch on the Buoy Deck. If this attack is ineffective or if the scene leader directs that a direct attack shall be attempted follow the procedures for a direct attack in the next section. Use a 1.5" fire hose equipped with a vari nozzle to cool the main deck and other fire boundaries as needed.

6. Direct Attack

A direct attack on Class A fires in this spaces is not recommended, however if the scene leader directs the preferred access to the compartment is from the Cargo Hold through the Longitudinal Passageway and two watertight doors. The #1 firefighting hose team should enter the Machine Shop with a 1.5" fire hose equipped with a vari nozzle configured to apply 6% AFFF on combination class A/B fires. The #2 firefighting hose team should back up the first team and enter the Machine Shop following the same attack with a 1.5" fire hose equipped with a vari nozzle configured to apply 6% AFFF. The #1 and #2 nozzlemen should be dressed out in FFEs and should not enter the space without an OBA. The #1 and #2 hose tenders should wear an OBA but they should not enter the space.

7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the weather deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

8. Other Actions

During firefighting actions the investigator wearing an OBA shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 shall be rigged as a backup source of firefighting water. The electrician should secure electrical power with the exception of lighting to the Machine Shop.

O. Engineering Control Center

1. Scenario

The most likely fire in this compartment is a class C fire in the MPCMS or switchboard.

2. Confining the Fire

The fire boundaries are bulkhead 52 forward and bulkhead 61 aft, the Main Deck and the hull. The watertight door to the Main Engine Room should not be opened to prevent the possible spread of fire and smoke into a space with a significant class B fire threat.

3. Sizeup

Due to the likelihood that crewmembers in this space are awake and alert, and the ease of egress forward, aft, and upward. there is little possibility that personnel may need to be rescued. Class C fires are usually extinguished when electrical power is secured, however a class A fire may be burning in conjunction with the equipment that was the cause of the class C fire.

4. First Aid

If the fire is discovered when it is small enough to attempt first aid the person discovering the fire should use a CO_2 portable fire extinguisher on Class C fires and a PKP portable extinguisher on Class A fires.

5. Indirect Attack.

If the compartment can be completely isolated an indirect attack through the emergency escape scuttle can be attempted with minimal risk to personnel. After securing electrical power to the Engineering Control Center insert a 1.5" hose fitted with a vari-nozzle set to water fog position through the 21" emergency escape scuttle in the Ship's Office. If this attack is ineffective or if the scene leader directs, a direct attack should follow the procedures in the next section. Use a 1.5" fire hose equipped with a vari nozzle to cool the Main Deck and other fire boundaries as needed.

6. Direct Attack

Class C fires in this space should be attacked by securing the electrical power to the affected equipment first and then attacking the remaining class A fire directly (charged capacitors in electronic equipment may retain a significant electrical charge after power is

secured). The #1 firefighting hose team should enter the Engineering Control Center from the Machine Shop through the watertight door in bulkhead 52 with a 1.5" fire hose equipped with a vari nozzle set to the water fog position. The #2 firefighting hose team should back up the first team and enter the Engineering Control Center through the same door with a 1.5" fire hose equipped with a vari nozzle set to the water fog position. The #1 and #2 nozzlemen should be dressed out in FFEs and should not enter the space without an OBA. The #1 and #2 hose tenders should wear an OBA but they should not enter the space.

7. Post-fire Activities

Smoldering materials should be jettisoned, with the Commanding Officer's permission, overboard or soaked in a bucket of water on the weather deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

8. Other Actions

During firefighting actions the investigator wearing an OBA shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 shall be rigged as a backup source of firefighting water. The electrician should secure electrical power with the exception of lighting to the Engineering Control Center.

P. Main Engine Room

1. Scenario

The most likely fire in this compartment is a class B spray fire due to a ruptured lube oil or fuel oil line on a main diesel engine. There is also a significant possibility of a class C fire in one of the motors or controllers or other electrical equipment in the Engine Room.

2. Confining the Fire

The fire boundaries are bulkhead 61 forward, bulkhead 79 aft, the Main Deck, and hull.. The Engine Room supply and exhaust fans shall be secured and the main engines shall be secured. The ship service generators shall be secured, and the Emergency Generator shall be started and placed on the line. The P-250 be rigged as a backup source of firefighting water in the event of a malfunction of the emergency generator.

3. Sizeup

The Engine Room in this cutter is normally unmanned, and the ease of egress forward, upward and aft make it unlikely that personnel will need to be rescued. Class B flammable liquid fires are effectively extinguished by 6% AFFF. If the space can be completely isolated to prevent the loss of agent, CO_2 is also effective against a class B fire. Experience has shown that flammable liquid spray fires are extremely difficult to extinguish unless the pressurized source of fuel can be secured. This space is protected with a fixed CO_2 total flooding fire extinguishing system. In addition, a fixed 6% AFFF

bilge sprinkling system is installed. Class C fires are best extinguished with CO_2. This agent has limited effect on flammable liquid fires since it has minimal cooling effect and is not persistent (such as AFFF), therefore reflashes are common.

4. First Aid

If the fire is discovered when it is small enough to attempt first aid the person discovering the fire should use a PKP portable fire extinguisher on a class B fire and a CO_2 portable extinguisher on a class C fire. As noted above, high priority should be given to securing pressurized sources of fuel.

5. Indirect Attack

If the compartment can be completely isolated (all doors, hatches, ventilation closures secured), a class B or class C fire may be indirectly attacked with minimal risk to personnel by:

- securing the main engines,
- securing the ship service generators,
- securing the ventilation fans,
- evacuating the space,
- securing electrical power to affected electrical equipment (class C fires) or securing the pressurized source of the flammable liquid spray fire (class B fires), and
- activating the installed CO_2 total flooding system only when so directed by the scene leader. If the fire is a class B fire, both the CO_2 <u>and</u> 6% AFFF bilge flooding systems shall be activated. If the fire is a class C fire, <u>only</u> the CO_2 flooding system shall be activated; the 6% AFFF bilge sprinkling system shall be kept on standby and activated only if the scene leader directs.

The scene leader and investigator shall monitor the effectiveness of the CO_2 and or AFFF by monitoring bulkhead temperatures and other appropriate means. The scene leader may direct re-entry in accordance with the direct attack procedures described in the next section after waiting a minimum of 15 minutes for the temperature to cool below the ignition point.

6. Direct Attack

For class B fires or following activation of the installed CO_2 flooding system, and when the scene leader directs, #1 firefighting hose team should enter the Engine Room from the Companionway on the Main Deck, down the inclined ladder, through the Engineering Control Center, and through the forward watertight door in the Engine Room with a 1.5" fire hose configured to apply 6% AFFF. The #2 firefighting hose team should back up the first team and enter the Engine Room following the same attack route with a 1.5" fire hose configured to apply 6% AFFF. The aft watertight door to the Pump Room shall be kept closed to prevent the spread of fire and smoke into a space with a significant class B fire threat. The bilges shall be blanketed with a minimum of 1/2 inch AFFF. The

#1 and #2 nozzlemen should be dressed out in FFEs and should not enter the space without an OBA. The #1 and #2 hose tenders should wear an OBA but they should not enter the space. A class C fire shall be attacked directly, by first securing the source of electrical power, then attacking the remaining class A or B fire with PKP or CO_2 portable extinguishers.

7. Post-fire Activities

Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA. Operate the supply and exhaust fans on high for at least 15 minutes after the Engine Room atmosphere has been tested and proven free of flammable gases.

8. Other Actions

During firefighting actions the investigator wearing an OBA shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 shall be rigged and energized as a backup source of firefighting water. The electrician should secure electrical power with the exception of lighting to the Engine Room. The covers should be installed over the Engine Room exhaust louvers and if available over the supply vent intakes. The Emergency Generator shall be started and placed on the line as an emergency source of electrical power (for the fire pumps and other vital equipment).

Q. Pump Room

1. Scenario

The most likely fire in this compartment is a class B fire in the fuel oil manifolds, there is also a significant possibility of a class C fire in the fire pump motor.

2. Confining the Fire

The fire boundaries are bulkhead 79 forward, bulkhead 88 aft, the main deck and hull.

3. Sizeup

This is an unmanned space, thus there is little possibility that personnel may need to be rescued. Class B flammable liquid fires are effectively extinguished by 6% AFFF. Experience has shown that flammable liquid <u>spray</u> fires are extremely difficult to extinguish unless the pressurized source of fuel can be secured. This space is protected with a fixed 6% AFFF sprinkling system. Class C fires are best extinguished with CO_2. This agent has limited effect on flammable liquid fires since it has minimal cooling effect and is not persistent (such as AFFF), therefore reflashes are common.

4. First Aid

If the fire is discovered when it is small enough to attempt first aid the person discovering the fire should use a PKP portable fire extinguisher on class B fires and a CO_2 portable extinguisher on Class C fires.

5. Indirect Attack

If the compartment can be completely isolated the fire may be indirectly attacked with minimal risk to personnel by applying 6% AFFF from a 1.5" hose equipped with a vari nozzle through the scuttle in the hatch on the main deck at the top of the ladder leading to the Pump Room. If this attack is ineffective or if the scene leader directs follow the procedures for a direct attack in the next section. Use a 1.5" fire hose equipped with a vari nozzle to cool the main deck and other fire boundaries as needed.

6. Direct Attack

A direct attack on Class B fires in this spaces is not recommended, however if the scene leader directs the preferred access to the compartment is from the Propulsion Thruster Room through the aft watertight door into the Pump Room. This attack route is preferred because it permits access to the compartment at the lowest possible level and it minimizes the possibility of fire and smoke spreading to the interior compartments in the cutter. An alternative access route is through the hatch and down the inclined ladder in the Companionway aft of the Mess Deck. This route is not preferred because it permits the possibility of fire and smoke spreading to interior compartments. The forward watertight door into the Engine Room shall remain closed to prevent the spread of fire and smoke into a space with a significant class B fire threat. The #1 firefighting hose team should enter the Pump Room with a 1.5" fire hose equipped with a vari nozzle configured to apply 6% AFFF against a class B fire. The #2 firefighting hose team should back up the first team and enter the Pump Room following the same attack route as the first team with a 1.5" fire hose equipped with a vari nozzle configured to apply 6% AFFF. The #1 and #2 nozzlemen should be dressed out in FFEs and should not enter the space without an OBA. The #1 and #2 hose tenders should wear an OBA but they should not enter the space.

7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, or soaked in a bucket of water on the weather deck. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

8. Other Actions

During firefighting actions the investigator wearing an OBA shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 shall be rigged as a backup source of firefighting water. The electrician should secure electrical power to the Pump Room.

R. Propulsion Thruster Room

1. Scenario

The most likely fire in this compartment is a class B fire in the propulsion units in this compartment.

2. Confining the Fire

The fire boundaries are bulkhead 88 forward, the transom aft, the 01 Deck and hull.

3. Sizeup

This is an unmanned space, thus there is little possibility that personnel may need to be rescued. Class B flammable liquid fires are effectively extinguished by 6% AFFF. Experience has shown that flammable liquid <u>spray</u> fires are extremely difficult to extinguish unless the pressurized source of fuel can be secured. This space is protected with a fixed 6% AFFF sprinkling system. Class C fires are best extinguished with CO_2. This agent has limited effect on flammable liquid fires since it has minimal cooling effect and is not persistent (such as AFFF), therefore reflashes are common.

4. First Aid

If the fire is discovered when it is small enough to attempt first aid the person discovering the fire should use a PKP portable fire extinguisher on class B fires and a CO_2 portable extinguisher on Class C fires.

5. Indirect Attack

If the compartment can be completely isolated the fire may be indirectly attacked with minimal risk to personnel by applying 6% AFFF from a 1.5" hose equipped with a vari nozzle through the hatch on the 01 Deck above the Propulsion Thruster Room. If this attack is ineffective or if the scene leader directs follow the procedures for a direct attack in the next section. Use a 1.5" fire hose equipped with a vari nozzle to cool the 01 Deck and other fire boundaries as needed.

6. Direct Attack

A direct attack on Class B fires in this spaces is not recommended, however if the scene leader directs the preferred access to the compartment is from the Pump Room through the forward watertight door into the Propulsion Thruster Room. This attack route is preferred because it permits access to the compartment at the lowest possible level. An alternative access route is through the hatch on the 01 Deck and down the vertical ladder into the Propulsion Thruster Room. This route is <u>not preferred</u> because it requires firefighters to descend a vertical ladder into a compartment involved in fire. The #1 firefighting hose team should enter the Propulsion Thruster Room with a 1.5" fire hose equipped with a vari nozzle configured to apply 6% AFFF against a class B fire. The #2 firefighting hose team should back up the first team and enter the Propulsion Thruster Room following the same attack route as the first team with a 1.5" fire hose equipped with a vari nozzle configured to apply 6% AFFF. The #1 and #2 nozzlemen should be dressed out in FFEs and should not enter the space without an OBA. The #1 and #2 hose tenders should wear an OBA but they should not enter the space.

7. Post-fire Activities

Smoldering materials should be jettisoned overboard, with the Commanding Officer's permission, soaked in a bucket of water on the weather deck, or taken to the pier and hosed down thoroughly. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

8. Other Actions

During firefighting actions the investigator wearing an OBA shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 shall be rigged as a backup source of firefighting water. The electrician should secure electrical power to the Propulsion Thruster Room.

S. In Port Fires

1. Scenario

The most likely fire in port is a class A fire in one of the Berthing Areas in bedding materials. A class B fire in the galley is the next most likely fire in port.

2. Confining the Fire

The fire boundaries are stated above and depend on the involved compartment.

3. Sizeup

Due to the likelihood of sleeping crewmembers, there is a strong possibility that personnel may need to be rescued. Class A combustibles are best extinguished by water fog. Deep-seated fires may require a solid stream for effective extinguishment. Note danger of electrocution is minimized with water fog due to the separation of the water particles; a solid stream should not be used unless electrical power (including lighting) is secured.

4. First Aid

If the fire is discovered when it is small enough to attempt first aid the person discovering the fire should use a PKP portable fire extinguisher on class A or B fires and a portable CO_2 extinguisher on class C fires.

5. Indirect Attack

An indirect or direct attack can only be attempted in the event additional help arrives on scene. This help can come from another Coast Guard Cutter, the Group or Station where the Cutter is berthed, or from the local fire department. An indirect attack may be attempted as described above for the particular compartment involved.

6. Direct Attack

A direct attack may be attempted if the scene leader directs in accordance with the procedures described above for the particular compartment involved. The scene leader is

the person on watch (in a one man duty section) until properly relieved by the normal scene leader in the crew or by a qualified person in the firefighting team from the local fire department.

7. Post-fire Activities

Smoldering materials should be jettisoned, with the Commanding Officer's permission, overboard, soaked in a bucket of water on the weather deck, or taken to the pier and hosed down thoroughly. Conduct atmospheric testing for oxygen and toxic gas levels before entering the space without an OBA.

8. Other Actions

During firefighting actions the investigator wearing an OBA shall continually inspect the fire boundaries to ensure the fire has not spread. The P-250 shall be rigged as a backup source of firefighting water if the scene leader so directs. The electrician should secure electrical power with the exception of lighting to the affected space.